THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

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# PC MAGAZINE

VOLUME 6 NUMBER 1
JANUARY 13, 1987

FIRST LOOK: MULTISCANNING MONITOR FROM SONY

- The AT Clone from IBM
- Connectivity: IBM Token-Ring Report Card
- Removable Hard Disks: Three Bernoulli Challengers

THE BEST OF 1986

*Third Annual Best and Worst: Editors' Personal Picks*

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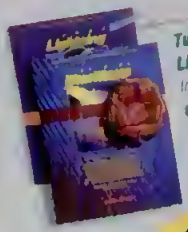

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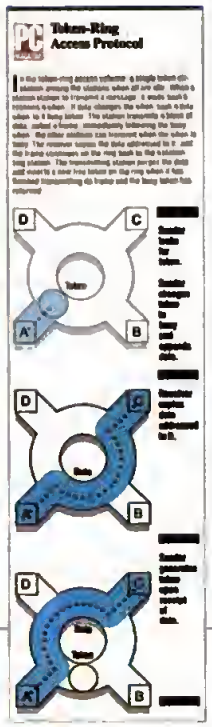


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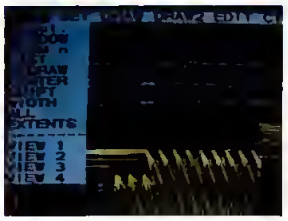


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# WHAT'S INSIDE

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In many industries, 5 years is hardly long enough to lock in even the barest of standards. Everyone from users to vendors to the press argues over subjects ranging from keyboard layout to user interfaces to graphics protocols. But as we take another year-end look at the microcomputer business, it's evident that traditions, if not standards, abound.

In this third annual best-of-the-year issue, the editors and writers of *PC Magazine* get personal about the products and industry trends of 1986. We spend most of the year objectively evaluating products. This is our traditional chance to add a healthy dose of subjectivity to the magazine. Turn to page 115 for a no-holds-barred look at the best and worst of 1986.

Another tradition at *PC Magazine* is ensuring that our benchmark tests are absolutely current with the rapid pace of technology. For years, users everywhere have relied on the tests to provide quantitative, comparative, and repeatable measurements. In this issue, we are introducing Release 4.0 of our benchmark test series, which contains some familiar benchmark tests and new File Access, BIOS Disk Seek, and DOS Disk Access tests.

The new BIOS Disk Seek test supersedes the popular Disk Access benchmark test from Core International. Both tests report hard disk random seek time, the most common hard disk performance measurement. But our new DOS Disk Access test avoids size limitations and uses DOS calls to access disk sectors directly. It differs from the BIOS Disk Seek test in that it will work with any DOS disk. This lets us compare a wider variety of devices, from RAM-disks to write-once, read-mostly (WORM) laser disks.

It's difficult to switch tests because users want to compare new results with the old. With this in mind we're now retesting existing industry-standard products, particularly the IBM PC, XT, and AT, to provide a consistent set of base-level comparisons.

We used the new benchmark tests to evaluate IBM's new PC-XT Model 286 and removable hard disks for two articles in this issue: "The AT Clone from IBM" on page 155 and "Drawing a Bead on Bernoulli" on page 217.

And in the *PC Magazine* tradition of giving readers the fastest hands-on evaluations of hot new products, we review Sony's CPD-1302 Multiscan monitor and Tandy's $799 1000EX computer.

We encourage all readers to obtain a copy of the PC Labs Benchmark Test Series, Release 4.0. You can download the tests from the PC Magazine Interactive Reader Service by calling (212) 696-0360 (300 or 1,200 bps, no parity, 8 data bits, 1 stop bit) or contact PC Labs at One Park Avenue, New York, NY 10016.

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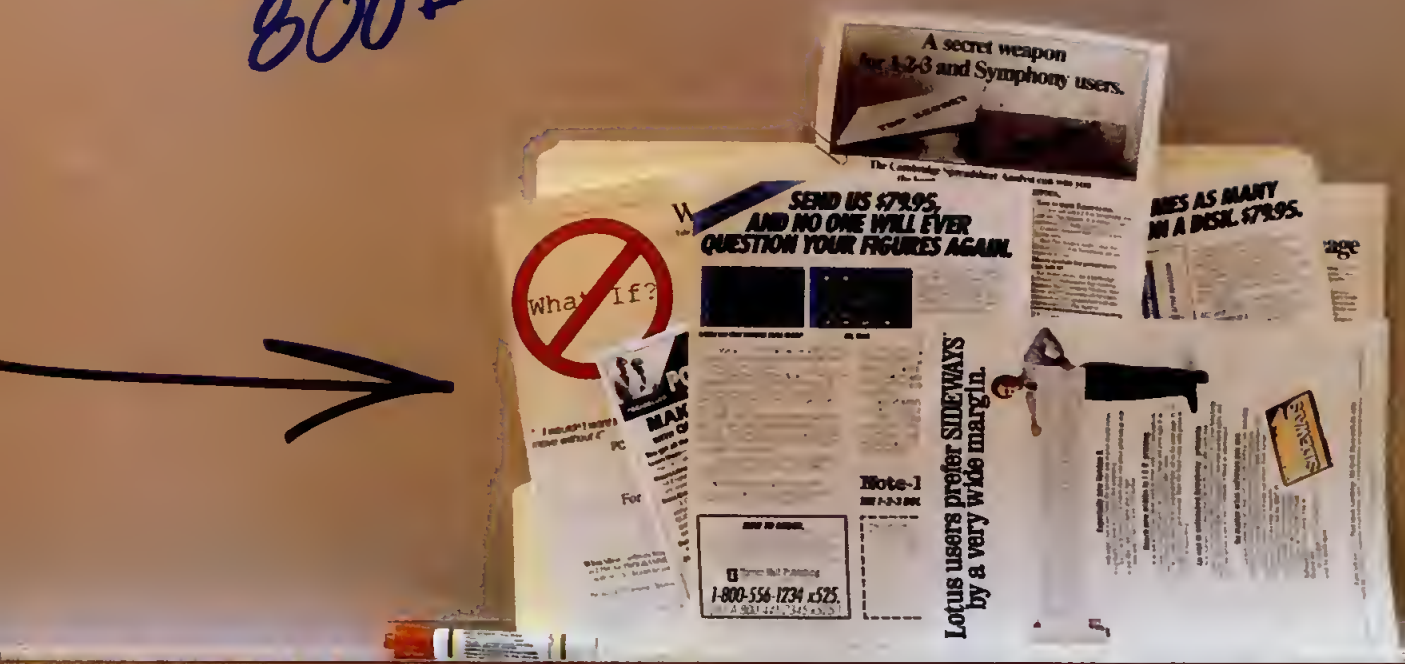


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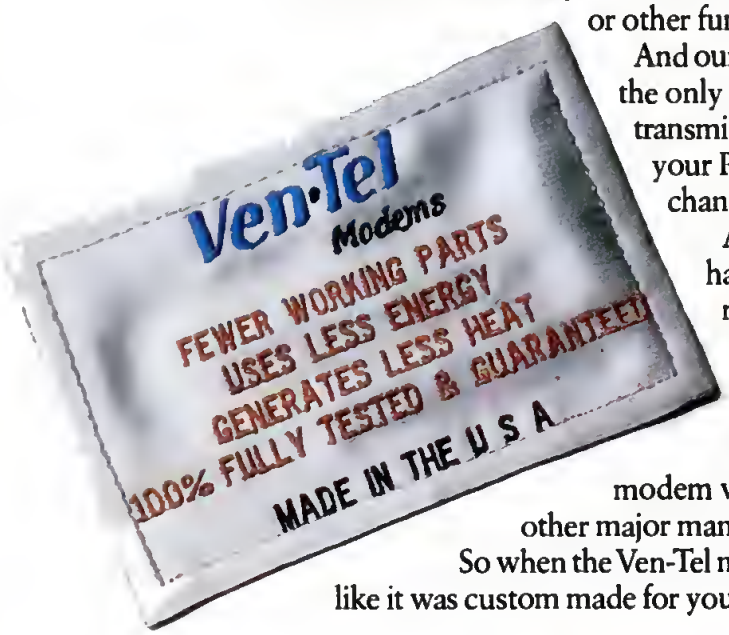


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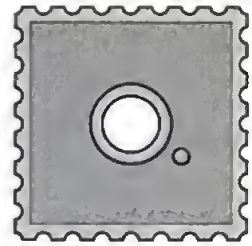
# LETTERS TO PC MAGAZINE



**CHEAPEST PCs EVER**

I anxiously awaited your article "The Cheapest PCs Ever" (*PC Magazine*, Volume 5 Number 17), only to be disappointed. I expected much more depth. You should have done a more thorough job. After all, it's not the quantity, but the quality that counts.

Neil J. Hoffman
New Hyde Park, New York

Your cover story "The Cheapest PCs Ever" does not do its subject justice. You have failed to report on the truly *cheapest* computers and, at the same time, have ignored several of the best low-priced PC clones. Your most unforgivable error, however, is to suggest that the IBM PC is the best of the low-cost compatibles. Where do you come off recommending the IBM PC as the best choice?

Stephen A. Risik
Lone Star Computer Co.
Killeen, Texas

Paul Stafford replies:

*As we were planning "The Cheapest PCs Ever" project, the list of machines that qualified swelled to nearly 50. We ordered every one, but most never reached the PC Labs for reasons known only to the manufacturers.*

*As for the selection of IBM's PC as our Editor's Choice, the reasoning was simple. First, in terms of quality control, reliability, documentation, compatibility, and support, it is still the best machine. Second, the PC is currently being so heavily discounted that it can be had for under $1,000. Third, after the poor showing by the "no-names," we felt that choosing the real PC was the best way to make a point: namely that smart shopping can net you a well-made, well-documented, well-supported PC for a fraction above what you'll pay for something far less secure.*

I read with interest your article "The Cheapest PCs Ever." I particularly enjoyed the section on "the assembled PC." As your article states, parts are easily available from a number of sources, and assembling a PC from its discrete components takes very little time and only a few common skills. While the savings from building your own PC are not enormous compared with the already low mail-order prices, the frustration factor is gone.

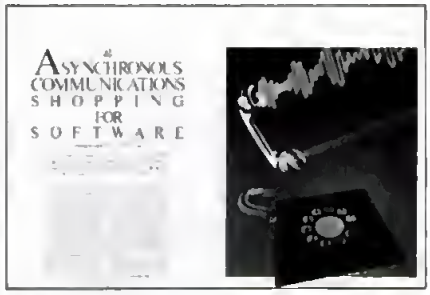
Dan Moore
Columbus, Indiana

A thought crossed my mind as I read "The Cheapest PCs Ever," and that is, you may indeed be better off buying the real thing from IBM in the form of a PC or PC-XT. (To my relief, you recommend doing this as your Editor's Choice.) Compatibility and dealer/service knowledge are assured, quality cannot be faulted, and the wealth of information available in the aftermarket press guarantees that an answer to almost any question is only as far away as your IBM representative or local bookstore.

Laurence D. Hammer
Reno, Nevada

**COMPREHENSIVE MODEM TESTS**

I consider your comprehensive product tests, such as the recent modem program tests in "Asynchronous Communications: Shopping for Software" (*PC Magazine*, Volume 5 Number 18), not only among the best performed by a computer magazine but also perhaps the single most useful editorial material in *PC Magazine*.




Father Winston F. Jensen
Superior, Wisconsin

I was especially looking forward to the communications software review in "Asynchronous Communications: Shopping for Software," but I couldn't have been more disappointed. If activity in the message areas of the local BBS is any indication, you're probably having to dig out from under a deluge of protest mail over having chosen not to include *ProComm* in your review. In view of the quantity of packages you chose to review, leaving *ProComm* out was, in my opinion, downright ludicrous and a real disservice to your readership.

Kevin Collins
Costa Mesa, California

Your feature on communications programs was very informative, but why did you leave out some of the best shareware

Finally, software you don't have to be rich to own.

We're PC-SIG. We have the world's largest library of user-supported programs (where authors ask that you send a donation) and free public domain programs. For only $6, you buy software that has been selected from leading authors, thoroughly analyzed, and technically supported. Perhaps that's why we've been referred to as the Robin Hood of software publishers.

☐ #310 **QMODEM** "One of the best communication programs I have ever seen" Supports common modems and runs up to 9600 baud.

☐ #499 **PROCOMM** Professional communications program written in compiled MicroSoft C and assembly code.

☐ #523 **SIDE WRITER** Perfect for spreadsheets, this application prints text files sideways.

☐ #528, 529 **NEW YORK WORD** Powerful word processing with split-screen editing, mail merge, auto hyphen, and more.

☐ #574 **FREECALC** Word processing and spreadsheet application for forecasting and budgeting.

☐ #78 **PC WRITE** Our most popular word processor. "I'm more at ease with PC WRITE than WordStar"

☐ #199 **PC-CALC** Business forecaster that's easier than Lotus 1-2-3. Includes tutorial.

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## ■ LETTERS

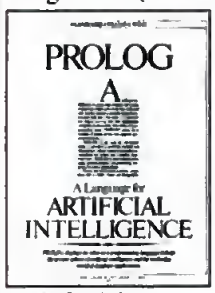
telecom programs such as *Qmodem*, *ProComm*, and *Pibterm*?

William Meacham
Austin, Texas

*In preparing for testing the many communications software programs available, we compiled an inclusive list of all available programs, weeded out those packages that did not have general-purpose communications, and then made our best effort to contact the software's producers to acquire a current copy of the selected programs. Although our original list included several shareware programs such as* Qmodem, *we encountered problems getting our hands on original distribution copies and were not willing to review downloaded copies in the event that they might have been modified. In the past, we have reviewed shareware programs, including* ProComm, *Version 2.0, and* Qmodem, *Version 1.09 (see "Shareware: Nominal Fees Can Yield Big Value," PC Magazine, Volume 5 Number 9). We will continue to review shareware programs provided we obtain original distribution copies from their publishers.—Ed.*

### DISTINCTION MUST BE MADE

Your review of PROLOG systems in "PROLOG: A Language for Artificial Intelligence" (*PC Magazine*, Volume 5 Number 17) provided your readers with an excellent analysis of the implementations available. William G. Wong did a superb job covering the PROLOG products, specifically our product, Arity/PROLOG.




While we are delighted with the coverage overall, we do wish that the distinction between interpreted and compiled tests had been made clear in the test results. The results listed for Arity/PROLOG are only interpreted. In actuality, the Arity/PROLOG Compiler produces results that are as much as ten times faster than the interpreted results—a significant difference.

Ronald Akie
Arity Corp.
Concord, Massachusetts

### CONCERNED WITH TESTING

I am writing in response to your article "Fast, Faster, Fastest: 9,600-bps Modems Arrive" (*PC Magazine*, Volume 5 Number 15). The article contained a review of four high-speed modems, including Digital Communications Associates' Fastlink.

As you pointed out in the sidebar to your article: "The most important variable in effective file transfer is the quality of the phone lines. Noise leads to errors, which mean resending parts of the file and slowing down the overall file transfer rate. The tests short-circuited this problem by connecting the modems back to back with a standard modular phone cable. While this connection ensures consistency in all the speed tests, it doesn't show what happens over normal phone lines."

The fact that the modem comparisons were done in a "sterile" laboratory environment concerns me.

As you recognized, Fastlink is unique in that it analyzes the entire voice bandwidth of the telephone line upon connection. It then chooses those select frequencies that are conducive to data transfer and discards those with high noise levels. This allows Fastlink to connect and maintain connection when other modems fail to do so. This is a key Fastlink feature that is ignored when laboratory and other non–real world tests are conducted.

It would appear that in order for a review to be truly meaningful, the products should be tested in the environment for which they are intended. And in the case of modems, that's the world of the public switched telephone network.

Carl Peede
Digital Communications Associates
Alpharetta, Georgia

M. David Stone replies:
*The whole point of benchmark-testing is to provide a controlled environment so that test results can be meaningfully compared. The problem with testing modems in the real world of the public switched telephone network is that there is no control. The*

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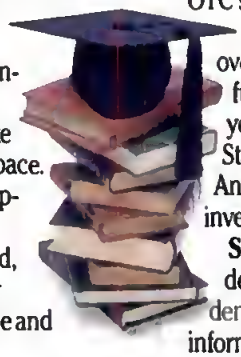

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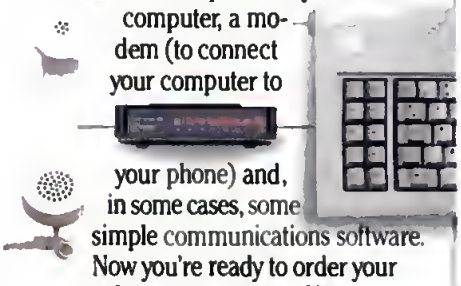

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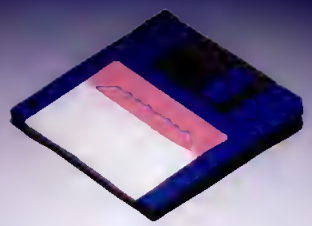
# The inventors of the 3.5" drive recommend only one floppy disk.

# Theirs.



If your computer has 3.5" drives, it has a little bit of Sony. Because Sony invented the 3.5" drive technology that has taken floppy disk memory all the way to two megabytes.

So nobody knows better than Sony how important high standards are for producing 3.5" floppy disks. But then, Sony invented those, too, as well as the most demanding methods for making 3.5" disks.

Such as the Sony Vivax™ magnetic medium, with the high coercive force necessary to suppress the "noise" that can cause disk error. And the Sony DDL™ binder system for incredibly even dispersion of magnetic particles on the disk surface. Then there's Sony's burnishing expertise that eliminates microscopic projections as small as 1/1,000,000th of a millimeter.

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## ■ LETTERS

*quality of a phone connection varies from call to call and even from moment to moment, so that better results may mean a better modem or simply a better-quality phone line. In such real-world conditions, benchmark-test comparisons become meaningless.*

*Better than either real conditions or the ideal conditions I used in testing the Fastlink and other high-speed modems would be a series of controlled tests using simulated best-case, worst-case, and average-case lines. PC Labs is currently developing a series of such tests. These may even include controlled bursts of noise to give error-correcting protocols a workout. However, any arbitrary pattern of noise may inadvertently favor one error-correcting scheme over another, and we are working to develop a test that will tell us something useful about how the modems will work in the real world of the phone network.*

### VIEWS ON VIEWPOINTS

I definitely agree with John C. Dvorak's and Stewart Alsop's reservations about people spending too much time formatting text for supposedly nice output on a laser printer ("WYSIWYG Mania" and "Is Desktop Publishing Fit to Print?" *PC Magazine*, Volume 5 Number 17). People are interested in the substance, not the style, of the text.

Raymond Chuang
Sacramento, California

Stewart Alsop's recent column "Is Desktop Publishing Fit to Print?" on the limited capabilities of the Hewlett-Packard Laserjet Plus is right on target. In the course of making our PC-based desktop publishing program work with the Laserjet, I discovered that the HP font cartridges are good for only 500 insertions. That fact is mentioned in the documentation, without indicating what you do when the $400 cartridge goes dead. Apparently, you throw it away and purchase a new one.

Bob Beecher
Madison, Wisconsin

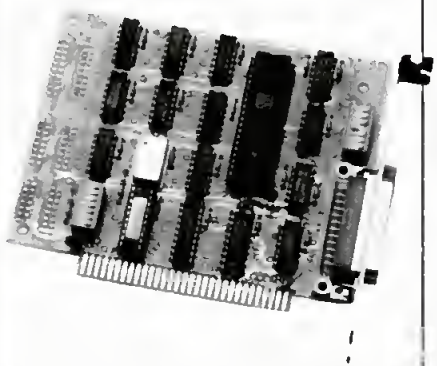
John C. Dvorak has the unique characteristics required for a computer industry gossip columnist. He has a broad base of experience, a large stable of sources, panache, and a personality that seems to suit the vehicle.

But does that mean that I always agree with him, that I find all that he writes interesting, or that I am completely fascinated by his tales of Comdex journalist parties? No! I simply admire his overall competence at his profession.

Richard Putman
Mankato, Minnesota

### CORRECTIONS/AMPLIFICATIONS

In the article "Micro-to-Mainframe Connections: SNA Remote Emulation" (*PC Magazine*, Volume 5 Number 16), we ran



the wrong picture in the accompanying fact file for IDEAssociates' IDEAcomm 3270/SNA board. The correct photo is printed above.

The *Kermit* communications software package from Columbia University is $15 ("Asynchronous Communications: Shopping for Software," *PC Magazine*, Volume 5 Number 18).

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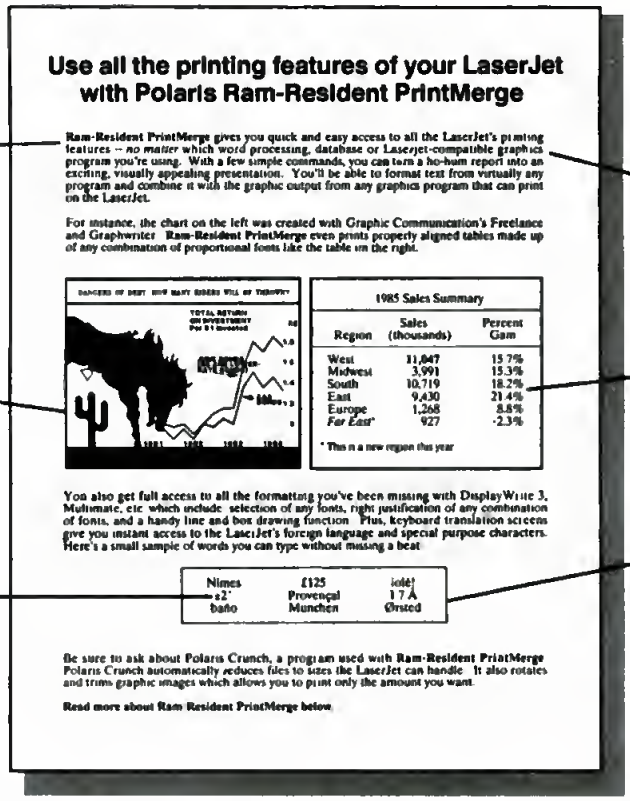


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Since Ram-Resident PrintMerge lets you merge graphics fram virtually any program that prints an the LaserJet, you can reinforce camplex ideas with illustratians right in the text. You can merge the graphic autput or save a screen image, and merge either in any of four print resolutions. If your graphics are too large for your LaserJet ta handle, try Polaris Crunch, a separate program that compresses, ratates and trims images.

Recommended by HEWLETT PACKARD

With the help of Ram-Resident PrintMerge's useful formatting features, your document will be as impressive as its contents. You'll be able to use LaserJet fonts in any combinatian for more attractive, readable text. And justify right-hand margins and align table columns printed with praportional fonts—even if they're downloaded fram diskettes. For extra emphasis, use Ram-Resident PrintMerge's line and box drawing capabilities and the LaserJet PLUS patterns to highlight important ideas.

And when you need to use extended or foreign language characters, Ram-Resident PrintMerge's five keyboard translation screens will put them at your fingertips instantly.

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Brief has text search abilities rivaling "grep", with wildcards for matching, indifference to intervening characters, acceptance of character ranges.

If you use Lattice, C86™ or Wizard, and have 320k, you can compile your C program without ever leaving Brief. It finds the lines with errors, and marches you through the text for repairs.

Parts of Brief were written with its own Lisp-like macro language which has structure, 32-character variable names, conditional execution, loops, and you can actually read it! Nothing like the hieroglyphs we've seen elsewhere. Bulletin board and public domain disks with macros. "Simply the best text editor you can buy" Dvorak *Infoworld* (Needs 192k.)

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| U0690 | $195 | **Call** |

## HALO GRAPHICS SYSTEM *Multi-Board Graphics Library*

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Windows for C™ is a library of over 80 functions to add the pizazz and practicality of window partitioning to your application. Unlimited windows, each defined in a C structure for easy reference throughout your program, can be made either to pop up or permanently overwrite the screen. Routines will scroll and highlight lists with arrow keys, will read and scroll ASCII files vertically and horizontally in windows, and even write to memory-loaded files off the screen.

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All functions are in separate modules, only those used are linked. Only buffers holding on-screen or temporarily obscured windows occupy RAM, others released dynamically. Best overall rating and fastest display in Bill Hunt's 7/85 *Tech Journal* review of five windowing products.

**Windows for Data** comprises all of Windows for C but takes in data through the windows as well. At the high level a single function lets you specify prompt string, field length, data type, screen location, picture, target variable, then sets lesser functions scurrying to get and process a user's input. There are utilities to get system date and time, mess with strings, create your own masks for fields.

Field options can require entry, prevent entry, permit insert or overtype, beeping on invalid or overflow keystrokes, and attachment of field-specific help messages and functions you want called to display messages or validate entries. And you decide which keys will clear a field, jump to the next or prior, quit, etc. Options diverse enough that a set of "fields" can be made to behave like a Lotus™ menu.

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| T0100 Windows for C | $195 | $149 |
| T0150 Windows for Data | $295 | $259 |

## MICROSOFT C 4.0 *A Great C Battle Rages and You're Winning*

As the dreadnaughts pound each other with ever heavier ordnance, today's programmers reap the spoils of this war. Bundling a source debugger and a "make" and sporting a "huge" memory model permitting single data objects larger than 64k, the Microsoft C compiler has jumped a full version number to 4.0. But what's really impressive are the benchmarks reported in Dr. Dobb's (8/86) encyclopaedic survey of 17 C compilers. Microsoft's and IBM's C (licensed from Microsoft) run away with the contest winning 11 of 27 benchmarks.

The CodeView™ debugger, free for a limited time, uses windows to show everything on one screen: source alongside disassembled object, variables, stack and registers. Drop down windows—use a mouse if you like—obviate learning of commands. A source-level debugger that puts the rest to shame" (Dobb's).

Microsoft C now has five memory models for code and data, plus non-library support for another thirteen, and boasts alternate math packages for speed versus accuracy, with or without 8087/80287 chips. A big plus in multi-language settings, call from this C any routine written in later versions of M'soft Pascal, FORTRAN or Macro Assembler. Object code of all four may be intermixed come link time or commingled into libraries.

Both linker and library manager are part of the package, as is the "make", a UNIX™ name for a smart batch program which knows to expend minimum effort to rebuild any size of project by compiling and assembling only elements affected by new or changed modules.

It is reportedly used by Lotus, Ashton-Tate and, fittingly, Microsoft itself to develop Windows. Dobb's calls it "the best MS-DOS C development environment value today [for] virtually any kind of program conceivable." 320k suggested.

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| C0500 | $450 | $295 |

## C-TREE *B-Tree File Manager, Source Code, No Royalties!*

C-tree is sturdy code that has weathered many seasons of prolonged and widespread use. It comes in C source, so you can modify it to fit a special case. No royalties provided you bind it into your binary application.

C-tree's design splits nodes to allow any number of users to access an index file simultaneously even when updates are in progress. So multi-user configurations and adaptation to networks are possible. Record-locking routines are provided for DOS 3.1/3.2, UNIX and XENIX.

Thanks to source code which does not deviate from the K&R standard, C-tree can travel. Tests in many environments prove that C-tree gives your application a ticket to anywhere.

C-tree permits any number of keys for a data file, supports duplicate keys, alphanumeric or numeric, supports files of variable record length, multiple keys in one index file, and keys of variable length. Both high level ISAM routines which handle details with minimum coding, and decomposed step-by-step functions you can access directly. It's comprehensive.

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## CURSES *Unix Style Screen Management*

Curses from Lattice™ manages the screen of the PC like Unix™ curses. Library of 84 functions and macros parallels Unix with matching parameter lists. So Unix programs are at home on the PC, and vice versa. Keeps any number of screens in memory, supports color, vast function set to get characters, wrap lines, scroll, blank lines, highlight, etc. Like Unix refreshes screen only on your command. Ask for L0860. List $125. Here $99. With Source L0860, $250/$199.

## dBC *Lattice Library Maintains dBASE Compatible Files With the Power and Speed of C*

dBC™ links C to dBASE. It creates and maintains files and their indexes which exactly replicate dBASE file design. So dBASE can read and update them. And the reverse. dBC can use any files created by dBASE. Now C and dBASE can operate on the same data bases interchangeably.

That opens up the widespread culture of dBASE installations to exploitation by C programmers. Tap that market, avoid the resident dBASE language, and gain the advantages of C with this single product.

dBC's functions parallel all dBASE's file handling commands, many decomposed to give closer control. Each backed by demo source files on disk.

Use dBC for custom work for clients, or on its own. It's a complete ISAM file manager for C whether or not dBASE will be used in tandem, supports all four memory models, and can have sixteen index and data files open. Big discount to buyers of both dBASE II and III versions. Specify Lattice, Microsoft 3.x, or DeSmet Versions.

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C source, assembler source, and binary libranes of 225 functions for many compilers. Emphasizes tight functional groupings to minimize loading code which your application may never use. Manual helps select functions, bulletin board, too.

A sampling: *DOS* extensions for file and directory manipulation, *Screen*: to select mode, page, monochrome or color, palette, cursor shape, positioning, clearing and scrolling, pixel get and put, read light pen. *Strings*: Center, justify, etc., efficient list operations which add, delete, sort string pointers for top speed. *Other*: graphics character primitives, keyboard status, function key assignment, time/date, read registers and memory size, peek and poke. Mature best-seller. Specify: S0770 & Compiler. List **$185**, Here **$139**

## PFORCE *Phoenix Pfunction Pfestival*

Lotus® didn't do badly pulling it all together in one place. Phoenix has followed suit with the ultimate integrated C library, offering everything from low level functions for hardware access to complete b-tree database management. Along the way are prerequisites such as string manipulation, time/date, field and screen editing, but also four styles of menus (Lotus included), windowing, background tasking, DOS interfaces, directory management, even interrupt-driven communications. Design emphasizes objects, so characteristics of windows, databases, records and fields can be initiated and changed outside functions.

One large collection in place of bits and pieces means one set of instructions and PforCe™ has tutorials, extensive examples, quick reference, and on-line help.

Everything in source, no royalties, all memory models of Lattice, M'soft. Specify S0220 & Compiler. List **$475**, PCB **$349**

## GREENLEAF *Hello World* COMMUNICATIONS

Want your application to communicate with other users or remote date bases by asynchronous communications built right into your C programs! Even if you don't need it now, that's a skill to have at the ready!

120 functions *and demo programs* in *both C and assembler source code* set up separate transmit and receive ring buffers for up to 16 simultaneous channels. Interrupt driven so you can halt an incoming record, display it, file it, let the user edit it, then continue. Goodbye separate communications software.

Supports up to 9600 baud, ASCII or binary, any parity or word length, 8250 UARTs, Xon/Xoff and Xmodem, WideTrack receive. Specify: S0750 & Compiler. List **$185**, Us **$139**

PRICE SLASHED!

## PRE-C *Pick the Lint from Your Program*

Pre-C is like UNIXs lint. It finds problems your compiler won't. Problems that a debugger will have trouble figuring out. Even problems which will cause trouble with other compilers.

Compilers see one module at a time. Modules only meet at link time. Pre-C looks at *all modules at once* and reports conflicts in data type declarations; function call parameters which disagree with functions, machine-dependent expressions which inhibit portability. It spots obsolete usage (even C changes), casts with suspect conversions, variables never used, functions never called, unreachable code. Adheres to UNIX System III compile standard to ensure your portability. Ask for P0590, List **$295**, Ours. **$208**

## DAN BRICKLIN'S DEMO PROGRAM *Storyboard Your Program*

The Legendary One has created Metaphor Two when the rest of us are still on Zero. Dan's first was the original electronic spreadsheet (VisiCalc™). This one is for programmers.

Words don't express program ideas because programs are screens! Dan's Demo creates slide shows. Create a screen — a snapshot of your planned product as it runs. Anything goes: words, borders, box rules, inverse and underlining of monochrome, fore- and background color. Copy this "slide" to an empty screen. Change it a little, to show the next instant of run-time. Do it again. Presto, a whole slide show of your program in action.

All 250 characters and attributes are available from scrollable lists which pop to the screen. All commands are layered in Lotus-style pop-up menus. Frequent choices mapped to function keys as well.

80x25 character mode, not bit-mapped.

Screen areas can be blocked for cut and paste or filled with color or characters, even blink. Slides can overlay on others, can be shuffled, deleted. Slides can proceed at time intervals or branch anywhere in the slide sequence depending on user keyhits.

Invaluable to prototype the program you are about to write, to position the labels, choose the color decor, smoothe out the keystroke interface. Or load the "capture" utility and snapshot the screens of any running program for an instant slide show.

Each copy entitles you to redistribute fifty of the slide projector program that runs demos. Plain manual, no binder keeps price of big product small. "Might become *the* essential tool in ... user interface prototyping," *Tech Journal*. Ask for N0100. List **$75** US **$69**

## BASTOC OPTIMIZES! *Translates BASIC Into C*

For a trifling price, BASTOC™ moves truckloads of BASIC code over to C. It's a translator which takes in Microsoft Extended BASIC and emits pure K&R C for Lattice 3.0. It will optionally convert your program into a single monolithic C function or decompose it into separate functions, one for each GOSUB label.

Version 2's optimization dramatically reduces execution time. Converts to integers those variables in BASIC programs which do not need floating point. Where BASIC uses full assignment statements to increment counters, BASTOC converts to C's compact form. Strings dynamically allocated, adding your application of BASIC's catatonic halts for garbage collection. Creates structure of even convoluted BASIC code. Huge worksaver.

| Ask for: | List | PC Brand |
|---|---|---|
| S0375 | **$495** | **$399** |

# Shopping List for the Power Workbench

| ASSEMBLERS & DEBUGGERS | LIST | OURS |
|---|---|---|
| **Advanced Trace-86** *Morgan, ASM Interpreter* | 175 | **149** |
| **Codesmith-86** *Debugger by Visual Age* | 145 | **109** |
| **Cdebugger** *by Micro-Software Developers* | 165 | **139** |
| **CSD Debugger** *C source level by Mark Williams* | 75 | **75** |
| **C-Sprite Debugger** *by Lattice, source level* | 175 | **139** |
| **Microsoft Macro Assembler** *with Utilities* | 150 | **109** |
| **PASM86** *by Phoenix. Macro Assembler* | 195 | **144** |
| **Periscope I Debugger** *Data Base Decisions* | 295 | **299** |
| **Periscope II** *Data Base Decisions* | 129 | **111** |
| **Pfix86 Plus** *by Phoenix, Symbolic Debugger* | 395 | **279** |
| **BASIC LANGUAGE** | | |
| **BetterBASIC** *Summit Software* | 195 | **165** |
| **BetterBASIC Utilities** *8087 Math Support* | 99 | **85** |
| *Btrieve Interface* | 99 | **85** |
| *Run-Time Module* | 250 | **225** |
| **Microsoft BASIC Interpreter** *for XENIX* | 350 | **295** |
| **Microsoft QuickBASIC Compiler** *full BASICA* | 99 | **79** |
| **Professional BASIC** *by Morgan* | 99 | **79** |
| **RM/BASIC** *by Ryan-McFarland* | 600 | **480** |
| **True BASIC** *True BASIC Inc* | 150 | **119** |
| *Run Time Module (Price slashed)* | 150 | **119** |
| **True BASIC Libraries** *Btrieve, Asyn, Sort, etc.* | Var | **Call** |
| **C COMPILERS** | | |
| **C-86 Compiler** *Computer Innovations* | 395 | **299** |
| **Lattice C Compiler** *from Lattice* | 500 | **299** |
| **Let's C Compiler** *by Mark Williams* | 75 | **69** |
| *with CSD Source Level Debugger* | 150 | **129** |
| **MWC-86: Mark Williams C Development** | 495 | **369** |
| **Microsoft C Compiler** *4.0* | 450 | **295** |
| **C INTERPRETERS** | | |
| **C-Terp** *by Gimpel Software* | 300 | **249** |
| **Instant C** *by Rational Systems* | 500 | **395** |
| **Interactive-C** *by IMPACC with debugging* | 249 | **219** |
| **RUN/C Professional** *from Liteboat* | 250 | **185** |
| **RUN/C** *without Loadable Libraries* | 120 | **109** |
| **TEXT EDITORS** | | |
| **Brief** *from Solution Systems* | 195 | **Call** |
| **Epsilon** *by Lugaru Software, like EMACS* | 195 | **199** |
| **FirsTime** *by Spruce Technology, C syntax* | 295 | **229** |
| **Kedit** *by Mansfield, similar to Xedit* | 125 | **115** |
| **LSE, the Lattice Screen Editor** *Multi Window* | 125 | **100** |
| **Pmate** *by Phoenix, with Macros* | 195 | **149** |
| **Text Management Utilities** *Grep, splat, diff, etc.* | 120 | **100** |
| **Vedit** *by Compuview* | 150 | **119** |
| **Vedit Plus** *by Compuview* | 225 | **180** |
| **FILE MANAGERS** | | |
| **Btrieve** *by Softcraft, no royalties* | 250 | **195** |
| **Btrieve Network** *by Softcraft* | 595 | **465** |
| **c-tree** *by FairCom — no royalties, source* | 395 | **329** |
| **dBC** *dBASE file manager from Lattice* | 250 | **195** |
| *with source* | 500 | **390** |
| **dbVista** *single user DBMS by Raima* | 195 | **159** |
| **dbVista** *multi-user DBMS* | 495 | **429** |
| **Opt-Tech Sort** *Can sort Btrieve files* | 149 | **119** |
| **SCREEN MANAGEMENT & DESIGN** | | |
| **Curses** *by Lattice, UNIX screen designer* | 125 | **99** |
| *with Source* | 250 | **199** |
| **Greenleaf DataWindows** *New* | 225 | **199** |
| *with Source simultaneously* | 395 | **297** |
| *Source purchased later* | 225 | **199** |
| **On-Line Help** *from Opt-Tech Data* | 149 | **119** |
| **Panel** *by Roundhill, no royalties* | 295 | **229** |
| **View Manager for C** *by Blaise* | 275 | **209** |
| **Vitamin C** *by Creative Programming* | 150 | **139** |
| **Windows for C** *Vermont Creative Software* | 195 | **149** |
| **Windows for Data** *includes Windows for C* | 295 | **259** |
| **ZView** *Data Management Consultants* | 245 | **199** |

| GRAPHICS | LIST | OURS |
|---|---|---|
| **Essential Graphics** *by Essential, no royalties* | 250 | **210** |
| **GSS Graphics Development Toolkit** | 495 | **375** |
| **GSS Kernel System** *by Graphic Software* | 495 | **375** |
| **GSS Kernel System** *for IBM RT* | 795 | **645** |
| **GSS Metafile Interpreter** | 295 | **235** |
| **GSS Plotting System** | 495 | **375** |
| **Halo Graphics Kernel System** | 300 | **219** |
| *with Dr. Halo II, by Media Cybernetics* | 440 | **299** |
| **COMMUNICATIONS** | | |
| **Asynch Manager** *by Blaise, for C or Pascal* | 175 | **149** |
| **Greenleaf Communications** *by Greenleaf* | 185 | **139** |
| **PTel** *by Phoenix, Binary File Communicator* | 195 | **149** |
| **Software Horizons Pack 3** | 149 | **119** |
| **UTILITY LIBRARIES** | | |
| **Blaise C Tools Plus** | 175 | **149** |
| **Blaise C Tools** | 125 | **109** |
| **Blaise C Tools 2** | 100 | **89** |
| **C Food Smorgasbord** *by Lattice* | 150 | **109** |
| **C Utility Library** *by Essential, 300 functions* | 185 | **139** |
| **Greenleaf Functions** *by Greenleaf Software* | 185 | **139** |
| **PforCe** *by Phoenix, vast library* | 475 | **349** |
| **Software Horizons** *Packages* | Var | **Call** |
| **TopView Tool Basket** *by Lattice, source avail* | 250 | **199** |
| **DEVELOPMENT TOOLS** | | |
| **Code Sifter** *by David Smith Software, Profiler* | 119 | **99** |
| **C-Worthy** *by Custom Design Software* | 295 | **269** |
| **C-Worthy for Network** *Menus, help, errors* | 495 | **449** |
| **Dan Bricklin's Demo Program** *Prototyper* | 75 | **99** |
| **LMK from Lattice** *by Lattice, "make" like UNIX* | 195 | **149** |
| **Microsoft Window Development Toolkit** | 500 | **365** |
| **PC-Lint** *by Gimpel Software, after UNIX's "lint"* | 139 | **125** |
| **PFinish** *by Phoenix, EXE performance analyzer* | 395 | **279** |
| **Plink86 Plus** *Utilizes memory for overlays* | 495 | **359** |
| **Pmaker** *by Phoenix, like UNIX "make"* | 125 | **105** |
| **Pre-C** *by Phoenix, UNIX "lint"-alike* | 295 | **208** |
| **Pfantasy Pac** *six Phoenix products* | 1295 | **895** |
| **OTHER TOOLS** | | |
| **BASTOC** *by JMI, convert BASIC to C . . .* | 495 | **299** |
| **BASIC-C** *BASIC's functions added to C* | 175 | **139** |
| **The HAMMER** *by OES Systems* | 195 | **179** |
| **Report Option** *by Softcraft, Btrieve Report Gen* | 145 | **129** |
| **Xtrieve** *by Softcraft, Query Utility for Btrieve* | 245 | **220** |
| **FORTRAN COMPILERS & UTILITIES** | | |
| **ACS Time Series** *by Alpha Computer Service* | 495 | **469** |
| **Forlib- Plus** *by Alpha Computer Service* | 70 | **59** |
| **Microsoft FORTRAN** *Links with Microsoft C* | 350 | **219** |
| **Microsoft FORTRAN** *for XENIX* | 695 | **546** |
| **Pro FORTRAN** *by Prospero* | 390 | **345** |
| **RM/FORTRAN** *by Ryan-McFarland* | 595 | **Call** |
| **Scientific Subroutine Library** *by Peerless* | 175 | **149** |
| **Scientific Subroutine Package** *by Alpha* | 295 | **299** |
| **The Statistician** *by Alpha Computer* | 295 | **269** |
| **Strings & Things** *by Alpha Computer* | 70 | **59** |
| **OTHER LANGUAGES & UTILITIES** | | |
| **Microsoft COBOL Compiler** | 700 | **499** |
| **Microsoft COBOL Compiler** *for XENIX* | 995 | **795** |
| **Microsoft COBOL Tools** *with Source Debugger* | 350 | **259** |
| **Microsoft COBOL Tools** *for XENIX* | 450 | **333** |
| **Microsoft Lisp** *New Common Lisp* | 250 | **199** |
| **Microsoft MuMath** *Includes MuSimp* | 300 | **199** |
| **Microsoft Pascal Compiler** *Links with M'soft C* | 300 | **199** |
| **Microsoft Pascal Compiler** *for XENIX* | 895 | **549** |
| **Pro Pascal** *by Prospero, ISD Validated* | 390 | **345** |
| **RM/COBOL** *by Ryan-McFarland* | 950 | **675** |
| **RM/COBOL 85** *ANSI 85 COBOL* | 1250 | **995** |
| **Source Print** *Aldebaran's diagrammer* | 139 | **109** |

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## RYAN-McFARLAND FORTRAN

### *A Mighty Fortress Is Their FORTRAN*

NEW!

Picking over features of rival products is not necessary if FORTRAN is your need, still the citadel of scientific and engineering work. Ryan-McFarland has left the competition battering at the gates.

RM/FORTRAN™ is a complete implementation of FORTRAN 77 (ANSI X3.9-1978), the only PC FORTRAN certified by the General Services Administration at the highest test level. The reason: it's a big mainframe compiler moved to PCs, with the bonus that mainframe and mini applications can wander between environments.

Now, on your PC, you can develop large applications, with programs up to 640k (bigger using overlays), arrays over 64k and using a long list of VS, VAX and FORTRAN-66 extensions you may have grown fond of — long symbolic names, "include", IRT bit functions — because R-M has left out nothing.

But what really sets RM/FORTRAN apart is optimization. The compiler reduces the number of instructions to the minimum which will actually execute, and even takes advantage of each processor's features to deliver lightning-fast object code. It runs 30%-40% faster than Microsoft 3.2, and could make your mainframe not worth the trouble.

Comes with an interactive symbolic debugger like that accompanying IBM VS FORTRAN, Plink86 subset, has a cross reference compile option, supports assembler and C subroutine calls, IEEE floating point, 8087 and 80287 chips.

"Compiler's documentation, ease of use, speed of execution, and debugger facilities place it first for recommendation" said the *Tech Journal* (10/85).

R-M has been writing FORTRAN compilers for IBM, DEC, etc. for 20 years. There is no greater expert.

| Ask for | List | PC Brand |
|---|---|---|
| I0300 | $595 | **Call** |

## RUN/C PRO

### *C Interpreter Links Binary Libraries*

Run/C comes in an apprentice and pro version. The professional model dynamically loads and unloads multiple binary function libraries like C-Food Smorgasbord™ and Halo Graphics™ — potentially any library compiled with Lattice's large model. Inside this interpreter your C program can reach for functions in the best of commercial libraries.

This C interpreter behaves like PC-BASIC meets WordStar®. Use fullscreen editing to create a program. RUN it. If it stumbles, LIST it, EDIT it, RUN it again, fix it again. Use familiar commands like LOAD, MERGE, SAVE, FILES, even TRON and TRACE.

Ideal for program development. Put up code at high speed, try out things devil-may-care, let RUN/C find your malaprops. Blast away until tight little code segments are undyingly faithful.

Lots more features: system interrupts, a shell command to invoke any operating system command without leaving Run/C, debugging aids ingeniously installed as a Run/C function. Call for debugging conditionally from within your program; a specific function or a menu of aids including immediate mode, single-step tracing, changing of variable values.

Manual shows how to develop the interface to a commercial library, using the Lattice compiler (a must!). Link your own function archive the same way (320k minimum, 512k recommended to fit libraries.)

Ask for S0950. List $250. PCB $185.

## PLINK86 PLUS

### *Cached Overlays Maximize Memory Use*

Long the overlord of overlay linkers, Plink86 shoehorns large programs into small machines by swapping program segments in from disk to save memory. A 512k program could run in a 128k machine, for example. But Plink86 Plus is smarter still: if it finds itself in a larger machine, it moves program overlays into leftover memory. Overlays now swap at memory speed not disk speed. Can automatically restore a displaced overlay to which a subsequently called overlay must now return, and assign library modules to the root segment or overlay areas. Plink86-Plus. List $495. Us. $359.

## LATTICE C COMPILER

### *Major Upgrades to the Best Selling C Compiler*

Lattice now embraces key UNIX™ enhancements which have entered the language since K&R: void functions returning no value, enumerated data types to assign stepped values to variables, data passing between structures by assignment.

The greatly expanded libraries (325 functions!) enable the file sharing and record locking provisions of DOS 3.1, provide a full complement of transcendentals, and a host of utilities to mimic the UNIX and XENIX™ environments.

Lattice 3.0 defaults to the ANSI proposed standard when you need strict adherence, but command line options restore leniency. And it adopts ANSI checking of external function arguments by data type to kill bug swarms when modules join up at link time.

Lattice now delivers smaller .EXE files, boasts very fast link times and a more efficient aliasing algorithm. New options generate code to use 80186 and 80286 features, 8087 of course sensed and utilized. Lattice has enjoyed pre-eminence so long that developers have created far more snap-on tools for Lattice C than any other compiler. William Hunt's *PC Tech Journal* review of 12 compilers awarded Lattice the only "very good" rating for add-on library availability.

| Ask for | List | PC Brand |
|---|---|---|
| S0100 | $500 | $299 |

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## BETTER BASIC

### *Convert Microsoft BASIC. Structured, Compilable.*

Combines the familiarity of BASIC with the best features of C, Pascal, and Modula-2, yet BetterBASIC is 100% compatible with Microsoft's GW™ BASIC and IBM BASICA including graphics, sound, and assembly language calls. So load your old programs and RUN. SAVE and they are converted automatically to BetterBASIC!

It's big. Needs 192k, programs can go to the PC's full 640k. It's comfy. Behaves like M'soft BASIC at the interactive level, with a full-screen editor, direct statement execution, and always poised to RUN. It's fast. Each statement checked and compiled once, not every time encountered. Sieve runs *6 times faster* than with M'soft.

C-like structures house file records so goodbye to FIELD, MKI$, CVD, LSET, etc. Named "procedures" replace GOSUBs to linenumbers. Lots more features: built-in linker for compiled modules, trace, debugging breakpoints, cross-reference command, 32k strings, DOS and BIOS calls and interrupts, recursion. Run-time module stores object code for redistribution.

| Ask for | | List | Us |
|---|---|---|---|
| S1200 | BetterBASIC | $195 | $165 |
| S1201 | Run-time Module | $250 | $225 |
| S1202 | 8087 Interface | $ 99 | $ 85 |
| S1205 | Btrieve Interface | $ 99 | $ 85 |

## GSS GRAPHICS SYSTEM

### *Leave the Device Driving to GSS*

ANSI CGI STANDARD! PRICES CUT!

GSS™ has reconfigured two components of its comprehensive graphics tools to conform with the ANSI Computer Graphics Interface (CGI) standard.

At the heart of the system is the Development Toolkit which contains all language interfaces and device drivers for keyboards, mice, joysticks, tablets, printers, plotters, cameras, and more. Drivers house management of vector graphics (plotters) and bitmaps used by raster input devices (scanners) to insulate the application program from concern for device idiosyncracy. No one else has implemented CGI that way. It means your programming remains generic, just switch drivers and the same program will drive a different device.

GSS Kernel™ conforms to level 2b of ANSI's Graphical Kernel System (GKS) and contains all its needed drivers and language bindings. Kernel has macro level tools to draw and color an object, store the sequential instructions, and recreate the object on its own, as well as segment it, transform it, etc. So powerful, a single command may represent several score lower level statements.

Plotting has the equivalent GKS tools for graph and chart generation and their captioning: hand it apples and oranges, say "pie", and it bakes the numbers into a digestible display for screen or plotters.

Kernel and Plotting have tools to convert images they create to ANSI Computer Graphics Metafiles (CGMs), a tokenized standard for storing every form of graphic image as data. The Metafile Interpreter reads the contents of a CGM and interprets it with full CGI capability for re-creation on various devices.

Quality software? IBM thinks so. They sell the GSS series under their own label.

Unit royalties and annual fees have been instituted for redistribution. Needs 256k.

| Ask for | | List | PC Brand |
|---|---|---|---|
| GS010 | CGI Dvlpmt Toolkit | $495 | $375 |
| GS020 | Kernel System | $495 | $375 |
| GS025 | Kernel for IBM RT | $795 | $645 |
| GS030 | Plotting System | $495 | $375 |
| GS040 | Metafile Interpreter | $295 | $235 |

## BTRIEVE

ASK ABOUT XTRIEVE & RTRIEVE

### *Queen B-tree File Manager Abdicates Royalties*

There's no longer a tithe to incorporate Btrieve™ in applications, a welcome proclamation if royalties would ruin your profit margins. Btrieve takes complete charge of all file creation, indexing, reading, writing, insertion, deletion, space recapture, forward and backward searching. It builds function call "commands" right into the language you use: interfaces to C, Pascal, BASIC, and COBOL, with sample programs in all four, come with each copy.

Btrieve has mainframe specifications! Its balanced-tree indexing scheme finds any key in a million in four or less accesses. Files may have up to 24 indexes, fixed record length to 4090 characters, indexes up to 255 characters, files of 4 billion bytes. Can even extend a file across two drives — even two hard disks!

Version 4.x speeds DOS interaction for large multiply-keyed files, enables variable length records of virtually any length, verifies accuracy (optionally) with read after write, useful in gritty environments, offers password and data encryption.

There's also Xtrieve, for Btrieve file inquiry and data manipulation, and Rtrieve for report writing. All three in versions for any network that supports the MS-DOS 3.1 file sharing function.

| Ask for | List | PC Brand |
|---|---|---|
| S0650 | $250 | $195 |
| S0652 | Network Version | $595 | $465 |

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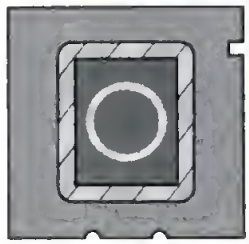
■ GUS VENDITTO

# PC ADVISOR



*Help in adding RAM beyond 640K to a Compaq, in accessing Wang word processing files on a PC, and in using two monitors with one system.*

### EXTENDING RAM

I need more RAM but I don't want to spend any more than I must. I have a Compaq 286 Portable with 640K RAM and use *Framework II* mostly, *Microsoft Word 3.0* occasionally, and assorted utilities. I would like to have another 300K of RAM. Eventually, I'll probably want more. I could also use another parallel port.

Robert Ratner
Los Altos, California

*Because your machine is packed to the maximum that DOS can ordinarily address, the most important feature to look for in a RAM card is support of the Lotus/Intel/Microsoft (LIM) expanded memory specification (EMS).*

*Your choices start with the well-made, no-frills memory boards from Boca Research (Boca Raton, Fla.; (305) 997-6227); its Bocaram series includes a 256K model for $245 and a 1-megabyte card for $395. They're packed with relatively fast 150-nanosecond chips and can run up to 12 MHz. No ports are included, but I/O cards can be had for about $80 from most mail-order houses these days.*

*AST Research (Irvine, Calif.; (714) 863-1333) lists its Advantage Premium at $695. That gets you 512K of 120-nanosecond RAM, a parallel port, and a serial port, plus Quarterdeck's* DESQview *multitasking software. The top of the line is the Above Board PS/AT from Intel Corp. (Santa Clara, Calif.; (800) 538-3373) with 1.5 megabytes for $1,095. It's expandable to 2 megabytes and includes parallel and serial ports.*

### WANG-TO-PC EXCHANGES

Is there any convenient way that word processing data produced on an IBM PC can be interchanged with a Wang System 25?

John S. Aynsley
San Carlos, California

*I regularly receive inquiries from Wang users who are loath to rekey mountains of data locked inside Wang floppy disks. A series of new products from General Information Services (Philadelphia, Pa.; (215) 557-1950) can translate these files from a number of Wang units but not the System 25. The System 25 is considered too ancient to warrant the investment of developing the translation software.*

*You could try an async communications transfer, but you'll have to do a lot of stripping of the format codes and a lot of monkeying around with the communications software's translation tables until you get it right. Your best bet is probably to take advantage of the disk-conversion service that General Information Services offers; prices range from $20 to $75, depending on the volume.*

*The company's* Archive-Link *($375) software converts Wang 5¼-inch disk files (OIS, VIS, and Alliance formats) to* MultiMate, DisplayWrite, WordPerfect, WordStar, *or* Office Writer *formats for use on a PC (or vice versa). The company's* VsCom *($375) is a terminal emulation program that makes the same Wang-to-PC transfers via an async hookup.*

■ Wang users are loath to rekey mountains of data locked inside Wang floppy disks. A series of new products can translate these files.

### TWO-MONITOR SYSTEMS

Is it possible to connect a color and a monochrome monitor to an IBM PC-XT at the same time? We need the sharpness of monochrome for word processing, but we also need color graphics for some programs. It is our belief that the motherboard won't accommodate a color and a mono card simultaneously.

Joseph Horvath
South Bend, Indiana

*Wrong. A CGA (or EGA) adapter and monitor will peacefully coexist with a manochrome adapter and monitor without any extra expenditures required. The DOS MODE command will make the switch (for example, MODE CO80 or MODE MONO); this utility comes with DOS.*

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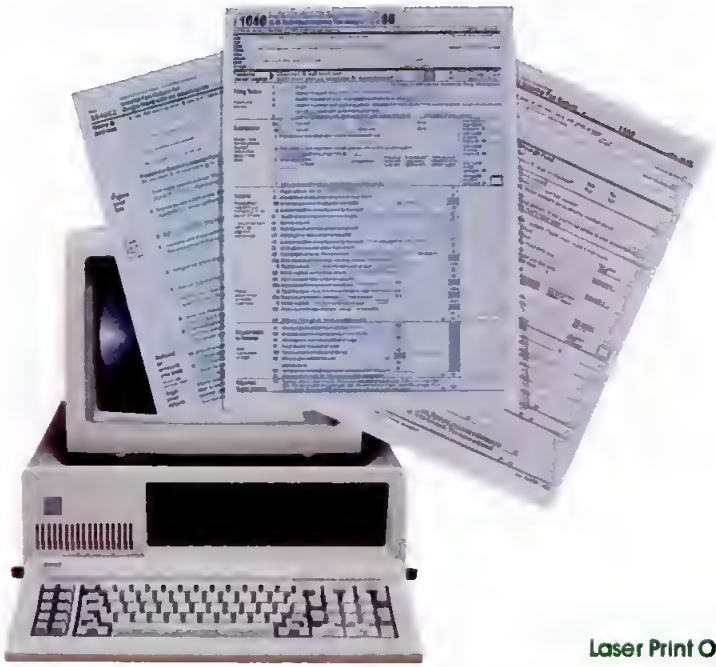

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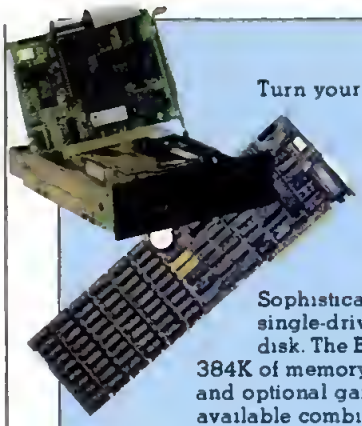

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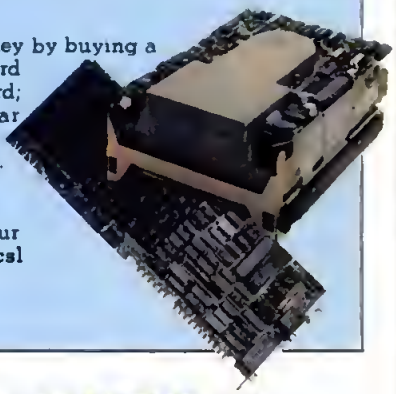

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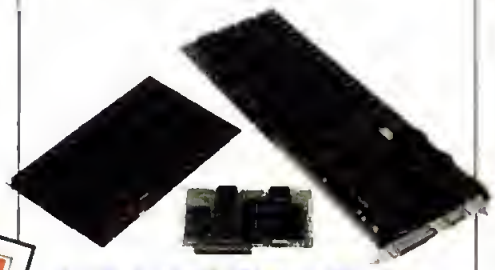

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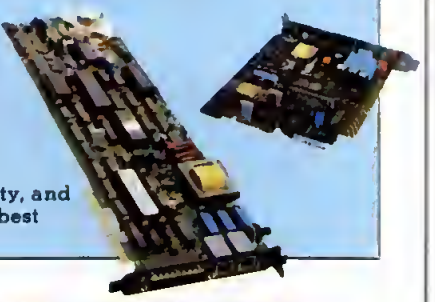

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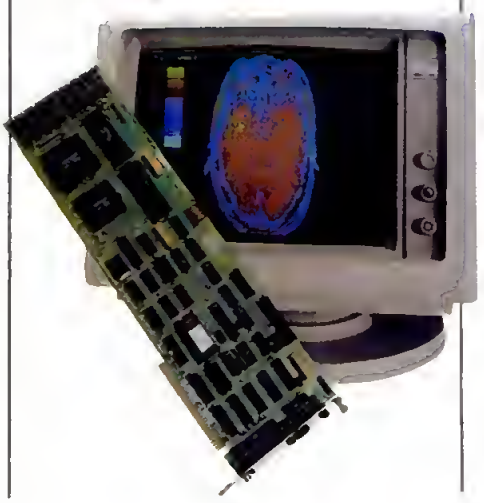

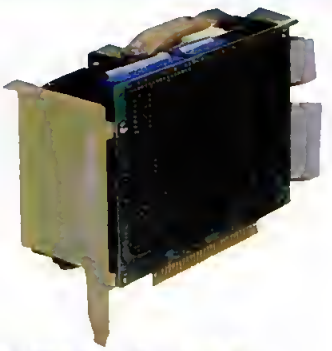

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PC MAGAZINE

# FIRST LOOKS

# Tandy's 1000EX, 3000HL: DOS for Home, Business

PC HANDS ON

BY JON PEPPER

There was a time when the name Radio Shack conjured up images of stodgy-looking computers that didn't fit into either the MS-DOS or Apple universes. Times have changed. Radio Shack computers, which now bear the Tandy name, comprise a broad line of products that can go head-to-head with the major names in the DOS world. Two of the most interesting offerings are the Tandy 1000EX and the Tandy 3000HL.

The 1000EX is clearly aimed at the home and educational markets. The appearance of the 1000EX suggests a somewhat oversized Apple II: an integrated unit that combines the system unit, a keyboard, and a single 5¼-inch floppy disk drive. The EX is compatible with the plain old IBM PC, but it adds a few frills, including dual-speed 8088 processing, running at either 4.77 or 7.16 MHz.

*The Tandy 1000EX is distinctly Apple-ish in appearance, but it runs an 8088 at two speeds, 4.77 and 7.16 MHz. the $799 unit comes standard with one 5¼-inch drive and a color/graphics adapter (but no monitor). The Tandy 3000HL, a good alternative to the IBM PC-XT Model 286, boasts a keyboard superior to many clones.*

The single floppy disk drive is located on the right side of the machine, along with two joystick connectors and a headphone jack with a volume control. The rear panel has standard ports for a parallel printer, an external disk drive, and mono-

(continues on page 34)

# Sony's Multiscan Monitor Challenges NEC MultiSynch

PC HANDS ON

BY PAUL M. STAFFORD

NEC's MultiSynch monitor has been without competition for so long, you might think the Japanese electronics behemoth was the only company that could make a plug-and-play multiscanning monitor. Finally, the time has come for the hottest-selling hardware device for the PC to step aside and share its market. Not surprisingly, the new kid on the block comes from another Japanese electronics giant—Sony.

The Multiscan's heritage is instantly recognizable. It looks so much like the Trinitron TV set that, when you get it out of the box, you'll think you got the wrong CRT. The label in the upper-left corner says Trinitron, and nowhere on the unit is there a Multiscan label.

Connect it to any color display card, though, and it more closely resembles the MultiSynch. Like NEC's breakthrough display, you can connect the Multiscan to anything that sends a horizontal scan rate of between 15 and 35 KHz, analog or digital, and it will work perfectly. This means it cohabits with any standard color card on the market, from CGA to PGC, automatically.

### Wonderful Display

Where the Sony distinguishes itself is in its wonderful display quality. In nearly every head-on comparison, the Sony shows itself to be equal or superior to the NEC.

While the upper limit on resolution is similar (900 by 560 on

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## Tandy

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chrome and color monitors.

Standard equipment also includes 256K bytes of RAM and three expansion slots, which can increase the memory to 640K, accommodate an internal modem, and provide other functions commonly associated with expansion slots. But don't expect to swap boards with other PCs—the slots in the 1000EX are proprietary. You'll have to buy expansion memory and options through Tandy.

Compatibility is not an issue; *WordPerfect*, an assortment of BASICA programs, *XyWrite*, *Crosstalk*, and other leading programs worked without any problem.

Although the performance of the 1000EX will not take anyone's breath away (even at the higher speed), it was certainly more than adequate for its intended market.

The only real drawback to the 1000EX is the keyboard, which was unacceptable even for a home machine. The layout is crowded and confusing, the feel is mushy, and important keys are placed in extremely nonstandard locations. The coup de grace is the proximity of the CapsLock key to the tiny Shift key, which I inadvertently clicked on and off every time I went to hit the Shift.

If you aren't dissuaded by the keyboard and the expansion-slot incompatibility, the 1000EX is a good value. The $799 price includes MS-DOS, GW-BASIC, and *Personal Desk Mate*, a version of Tandy's serviceable integrated software that has been optimized for ease of use with pull-down menus and dialogue boxes.

If the 1000EX is a home machine, the 3000HL was obviously designed for business use. The 3000HL is somewhat similar to the IBM PC-XT Model 286—in that it's an XT compatible that's powered by an 80286 processor, running at either 4 or 8 MHz. There are seven expansion slots inside this hefty (33 pounds with no hard disk) well-built unit: four 8-bit and three 16-bit, all IBM compatible.

Standard fare (for $1,699) includes 512K bytes of RAM, a parallel printer port, and a 360K 5¼-inch floppy disk drive. Tandy sells MS-DOS, GW-BASIC, and *Desk Mate* bundled together for $99.95.

Tandy sells a 20-megabyte,

### FACT FILE

**Tandy 3000HL**
Tandy/Radio Shack
1700 One Tandy Center
Fort Worth, TX 76102
(817) 390-3300
**List Price:** $1,699, including 512K RAM, parallel port, one 5 ¼-inch floppy disk drive; hard disk controller, $399; 20-Mbyte drive, $799; 40-Mbyte drive, $1,799; Deluxe Video Display card, $399.95; Dual Display card, $249.95; CM-1 enhanced RGB monitor, $529.95.
**In Short:** An XT compatible that's powered by an 8-MHz 80286 engine. A solid machine for the business marketplace.

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**Tandy 1000EX**
Tandy/Radio Shack
1700 One Tandy Center
Fort Worth, TX 76102
(817) 390-3300
**List Price:** $799, including 256K RAM, parallel port, color/graphics adapter, one 5 ¼-inch floppy disk drive, MS-DOS, GW-BASIC, and *Personal Desk Mate* software; memory expansion to 384K, $129.95; external 5 ¼-inch disk drive, $249; CM-5 RGB monitor, $299.95.
**In Short:** A well-priced integrated PC compatible that comes with everything except the monitor. Except for a nonstandard keyboard, it's a good value for home or school.

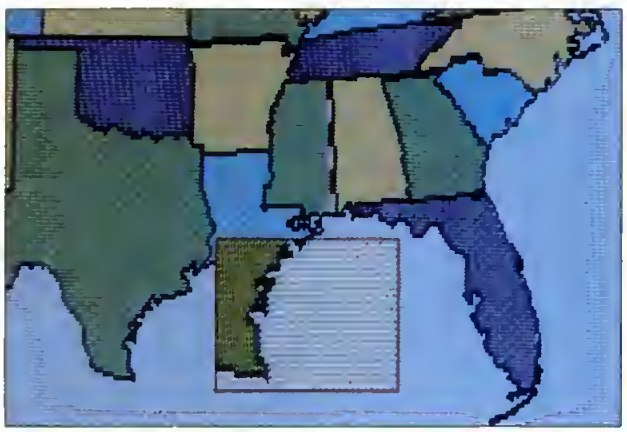
CIRCLE 424 ON READER SERVICE CARD

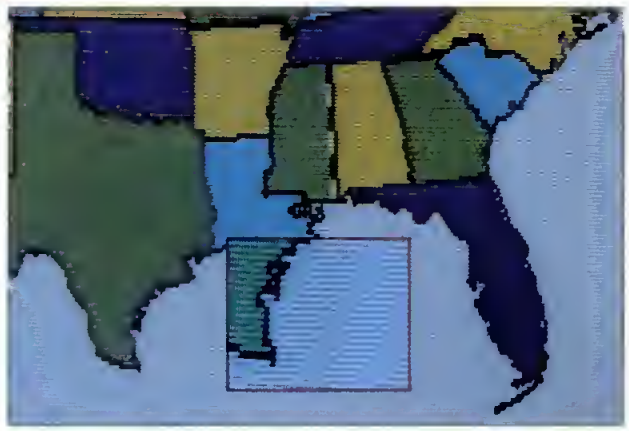
## Sony

(continued from page 33)

the Sony; 800 by 560 on the NEC), the Sony's dot pitch is slightly finer—.26 millimeter to the NEC's .31 millimeter. The difference is barely perceptible to the naked eye, and only when they're sitting side by side does the Multiscan appear ever-so-slightly sharper—especially in the EGA's mode 16 (16-color 640 by 350 graphics).

The Multiscan also has a much darker black and less-reflective background than the MultiSynch. As with the Trinitron TV sets, the Multiscan's colors appear richer, since they contrast better with their background. An added advantage is





*Rating monitors is a subjective matter. While the colors on a NEC MultiSynch (right) appear richer in photographs, the Sony Multiscan (left), to us, seems to have an edge in direct viewing. The NEC gives off more light, so the camera captures the colors better.*

*The Sony's superior sharpness is attributable to its finer dot pitch (.26 mm. versus the NEC's .31 mm.), and to a darker background. Inset, the photos of the screen magnified 200X illustrate the finer dot pitch's effect.*

85-millisecond hard disk for $799; a 40-megabyte version with a 28-millisecond access time sells for $1,799. You'll have to buy the controller separately; it's $399.95 for either model.

The keyboard is the standard AT-style layout, with LEDs for the locking keys embedded in the keycaps and a reasonably good tactile feel. There are a number of video and monitor options available from Tandy, though you could buy other PC-compatible combinations; I tested Tandy's Deluxe Video Display Adapter coupled with the high-resolution CM-1 monitor. It is CGA compatible and also works with drivers for the Super RES 400 and Graphix Plus II boards from STB. The CM-1 monitor produced a fairly nice screen display; almost as good as the IBM Enhanced Color Display.

Compatibility was flawless, and performance for the 3000HL was on a par with other 8-MHz XTs. Overall, the 3000HL is a rugged performer for the business market. If you are attracted by Tandy/Radio Shack's reliability and nationwide service and support, this machine is worth a look.

*Next issue, First Looks will review Tandy's Model 1000SX.*

## Benchmark Tests: Tandy 1000EX and 3000HL vs. IBM PC-XT

The biggest surprise in benchmark-testing the two Tandy machines against IBM's 8088-based PC-XT is the fast performance of the 1000EX's floppy disk drive. Here we tested each machine's floppy disk drive because the 1000EX can not accommodate an internal hard disk. Our other tests showed the 3000HL's hard disk to have a remarkably fast 21-millisecond access time.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

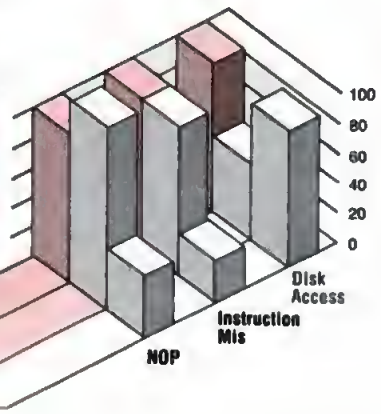
The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

**Performance Times**
(Times given in seconds and decimal seconds except where noted)

| Product | NOP | 8086 Instruction Mix | DOS Disk Access (milliseconds) |
|---|---|---|---|
| IBM PC-XT | 10 14 | 32 02 | 234 70 |
| Tandy 1000EX | 12 41 | 31 93 | 120 90 |
| Tandy 3000HL | 4.16 | 8.96 | 215 28 |

**Relative Times**
(Ratio: IBM PC-XT = 100)




that less glare is produced by ambient light, making the Multiscan easier on the eyes over long periods of use.

The brightness and contrast knobs also have more of an effect than they do on the MultiSynch, or for that matter on IBM's Enhanced Color Display (ECD). Having such a great degree of control over the contrast level on an EGA-compatible monitor is a revelation, especially when working with text. Finally, you can turn down the brightness knob as low as you want without watching characters fade into the background.

### Brighter Brights

But where the Sony shines is in handling color. Especially on some of the earlier MultiSynchs, the difference between high- and low-intensity colors is difficult to distinguish, a source of trouble for word processors that use high intensity to differentiate block definitions. Current NEC units have mostly corrected this problem, but Multiscan still has the edge. I own a MultiSynch, and thought its color quality was good, but the Multiscan's colors are clearly richer and more colorful (though neither monitor is as accurate as the IBM ECD). Even brown, which IBM seems to have a proprietary hold on, looks distinctly brownish.

Sometimes first is not necessarily best. Besides building a better display, Sony has also fixed the MultiSynch's small ergonomic problems. The on/off switch and the brightness and contrast controls are within easy reach on the right-hand side of the monitor. The brightness and contrast knobs are big and easy to find, like radio dials rather than the little finger-twirlers some people. This should be fixed, but doesn't really affect the quality of the display.

Sometimes first is not necessarily best. Besides building a better display, Sony has also fixed the MultiSynch's small ergonomic problems.

The Multiscan lists for $180 more than the MultiSynch when you add in $30 for Sony's essential tilt/swivel stand and cable; possibly even more if you consider that the MultiSynch has been in the retail channels long enough to be subject to considerable discounting.

We've become so spoiled by the NEC MultiSynch that anything less would be immediately apparent and completely unacceptable. The Multiscan at least meets and in most cases exceeds this high minimum standard. Its plug-and-play-ability is comparable, and its sharpness, contrast, and color-handling are noticeably superior.

### FACT FILE

**CPD-1302 Multiscan**
Sony Corp. of America
9 W. 57th St.
New York, NY 10019
(212) 371-5800
**List Price:** $945; tilt/swivel stand and cable, $30 extra.
**In Short:** A multiscanning plug-and-play monitor with a better display than the NEC MultiSynch.

CIRCLE 428 ON READER SERVICE CARD

# MathCAD Solves Equations On a Free-form Scratch Pad

HANDS ON

An unformatted screen gives *MathCAD* the flexibility to solve equations as you conceive or change them, with few restrictions. Warning: it could prove addictive.

BY ELLEN R. SKLAVER

What the pocket calculator did to the slide rule, MathSoft's *MathCAD* threatens to do to the engineer's quadrille-ruled pad. *MathCAD*, dubbed the "engineer's scratch pad," is a convenient equation editor capable of creating and printing professional-looking pages of equations and text.

For anyone who's mathematically oriented, *MathCAD* could easily become indispensable: it has a free-form style that lets you just sit down in front of the PC and do the work that you probably bought the computer for in the first place.

A typical screen is reminiscent of a carefully done problem set, complete with constant values, dimensional definitions, equations, solutions, and the inevitable plot.

The perfection was slightly marred by the fuzzy text appearance on my EGA monitor. In addition, when returning to a document from *SideKick*, the upper portion of the screen contained red snow, though it was quickly eliminated using *MathCAD*'s screen-refresh key.

## Intuitive Entry

It's far from being a word processor, but *MathCAD* is an excellent example of WYSIWYG document processing. Operations such as division, square roots, and summation are represented by familiar blackboard symbols, which you enter with intuitively chosen keystrokes. Formatting commands allow you to control document appearance on the screen, and the built-in print command writes to either a graphics printer or a file.

*MathCAD* handles decimal, hexadecimal, and octal representations of real and imaginary numbers. User-defined functions supplement the library of built-in functions and operators, which includes trigonometric, hyperbolic, and Bessel functions, as well as square root and summation operators.

Perhaps the strongest technical feature of *MathCAD* is its ability to handle ranges and subscripted variables. These facilitate iterative calculations, such as numerical integration, and multiple floating-point calculations for function graphing.

Creating a graph is as simple as specifying the axes and labeling the endpoints. Another powerful feature is *MathCAD*'s ability to handle dimensions. User-defined units function as numbers in equations.

## Error Detection

*MathCAD* checks for dimensional consistency—it won't let you add feet to pounds—and it flashes graphics messages when it finds an error.

Since documents can easily be merged, you can maintain unit definitions and other equations as library documents.

If you forget what you've got on disk or require other DOS functions, *MathCAD* includes a DOS shell command so that you can process a DOS command or run another application. This last feature is dependent on system memory; if you tend to fill yours with resident programs, forget it.

Most *MathCAD* definitions are local, affecting only those below them. So, the location of equations on the screen is important. This translates to saved time since the program only recalculates equations below a local value that has been changed. The program optimizes its calculation order. Further user optimization involves setting up the equations as if you had to solve them by hand.

## Time Lag Acceptable

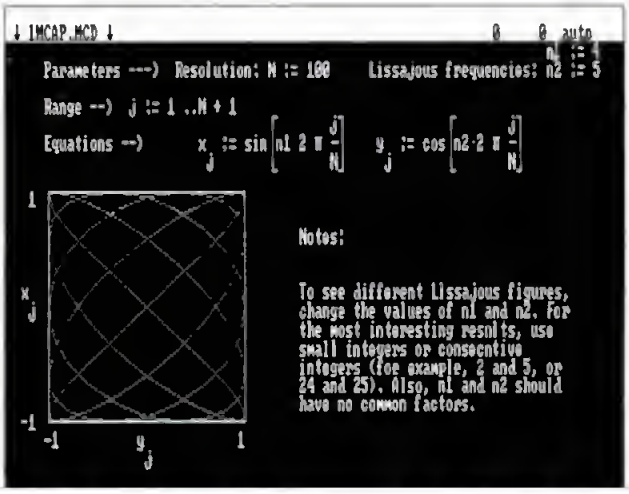
When running the program on an AT compatible I found recalculation to be slow but acceptable for reasonable iteration levels. You can reduce waiting time by using the manual recalculation mode and/or by adding a math coprocessor. However, there are compatibility problems with some non-IBM PCs, requiring that you disable the coprocessor.

Several file functions enable *MathCAD* to interact with external data files in a limited number of formats. I was able to read *VP-Planner* files exported to .SDF format, as well as a simple *dBASE* report file with the blank header lines removed.

The input format uses numbers delimited by any nonnumeric character. The output format is simply as many numbers as can fit on an 80-character line, separated by spaces. This necessitates some reformatting before data is read by other programs.

The documentation and keyboard functions are well organized, making the program easy to master. Numerous warnings and notes in the manual are a nice way of saving you from confusion on subtle issues.

Despite its limitations, *MathCAD* is an excellent new product, which may just become the new engineers' trademark. If you're not an engineer, you may get hooked anyway. For anyone who enjoys mathematics, *MathCAD* could easily become a regular pastime. PC




*Equations appear as they would on a blackboard.* MathCAD *recalculates and replots as parameters, subscript ranges, and equations change.*

## FACT FILE

***MathCAD*, Version 1.0**
MathSoft Inc.
1 Kendall Sq.
Cambridge, MA 02139
(617) 577-1017
**List Price:** $189
**Requires:** 384K RAM, graphics controller (CGA, EGA, Hercules Graphics Card, or compatible), DOS 2.0 or later. 8087 or 80287 coprocessor recommended.
**In Short:** Easy-to-use electronic scratch pad for engineers who don't like to erase, recalculate, and redraw.

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The obvious solution to avoid expensive duplicate peripherals is a local area network that allows you to share printer and disk drives. But until now LANs have cost in excess of $1,000 per PC.

**THE *EasyLAN*™ OFFICE NETWORK**

*EasyLAN* shares printers and disk drives between IBM PCs. *EasyLAN* can save you $1,000 or more per PC by eliminating duplicate equipment purchases.

**EasyLAN HIGHLIGHTS**

- ***EasyLAN* shares printers, plotters, data, and disk storage**
- **PC to PC file transfer**
- **Print spooling**
- **New PBX support**
- **Easy to install**
- **Easy to operate**
- **Modem support**
- **Performs in the background**

*EasyLAN*'s low price matches the small business user's cost-sensitive budget. It is the office network solution for less than $100 per PC including cables and software for a 2-PC or 3-PC network.

*EasyLAN* performs its operations concurrently in the background. *EasyLAN* communications, file transfers and printer operations all take place while each PC simultaneously performs such normal DOS applications as Lotus 1-2-3,™ WordStar,™ and dBASE.™

**NEW PBX SUPPORT**

New PBX support allows *EasyLAN* to transfer data files and share peripherals between PCs using PBX circuit-switched connections and twisted pair wiring. *EasyLAN* has already been installed on a number of different PBX systems and has been certified by Northern Telecom on the Meridian SL-1.

*EasyLAN*'s performance meets your small office or department requirements to move word processing documents and spread sheets between PCs. For example, *EasyLAN* can transfer a 10-page document between PCs as a background operation, in less than one minute.

*EasyLAN* loads automatically at boot time. It manages the PC's serial and parallel ports for communications and printing.

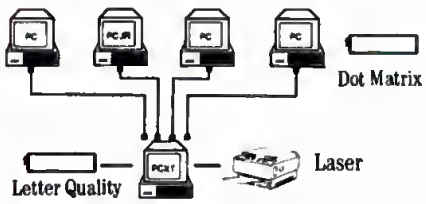
*"The value is high.* 🎖🎖🎖🎖*"*
**—InfoWorld Report Card**

Printer sharing operates transparently with existing programs. Print files are automatically spooled to disk and scheduled for printing. Multiple printers per PC may be designated for specific office tasks.

*"I bought access to a laser jet printer for $80."*
**—CONOCO Oil User**

Disk sharing uses *EasyLAN*'s EZCOPY command to move files to and from PCs. ASCII or binary files can be transferred in the foreground, or in the background while other DOS programs run.

All communication operations are protected by a unique password assigned to each PC so security is maintained.




***EasyLAN* Office Network**

***EasyLAN* SPECIFICATIONS**

Each PC in the network requires an individual licensed copy of the *EasyLAN* program and takes 20k of memory on each satellite PC, a serial port, and DOS 2.0 or above. *EasyLAN* disks are not copy protected. *EasyLAN* runs on all IBM PC models and Compatibles. The HUB PC requires a serial port for each satellite PC. The COM2 and COM6 boards are serial port expansion boards which permit you to add serial ports to the HUB PC.

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**—PC Magazine**

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**—Mini Micro Magazine**

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Name on Credit Card _____

Cr. Card No. _____ Exp Date ___/___

Server Technology, Inc., 1095 East Duane Ave. #103
Sunnyvale, CA 94086 Telex 5106003481

| Item | Description | Price | Qty | Amount |
|---|---|---|---|---|
| EL 01 | *EasyLAN* Kit—for 2-PCs 30′ cable, two disks & manuals | $179.95 | ___ | $ ___ |
| EL 02 | *EasyLAN* Expansion Kit—for 1-PC 30′ cable, one disk & manual | $109.95 | ___ | $ ___ |
| EL 11 | *EasyLAN* disk & manual (3½″ disk $89.95) | $ 79.95 | ___ | $ ___ |
| EL 12 | *EasyLAN* 30′ cable | $ 49.95 | ___ | $ ___ |
| EL 13 | COM2-serial port expansion board, two ports | $219.95 | ___ | $ ___ |
| EL 14 | COM6-serial port expansion board, six ports | $489.95 | ___ | $ ___ |
| EL 15 | Custom length cables, call for quote | | | |
| | CA res add applicable sales tax | | | $ ___ |
| | Shipping charge USA $10.00, other $20.00 | | | $ ___ |
| | **TOTAL ORDER** | | | $ ___ |

CIRCLE 520 ON READER SERVICE CARD

# Words & Figures Puts 1-2-3 Power Inside a Text Editor

HANDS ON

BY CHRISTOPHER BARR

Lotus *1-2-3* clones are a dime a dozen these days, but *Words & Figures* is a clone of a different color. What makes it special is a word processing module that lets you embed "live" worksheet cells into documents.

The figures module of *Words & Figures* is quite satisfactory as a *1-2-3*, Release 1A, workalike. It even has some of the improvements, such as EGA support and the ability to hide cells, that Lotus put into Release 2.

*Words & Figures* has two system disks, one for systems with 256K bytes of RAM and another if more RAM is available (the program uses overlays, so having more RAM cuts down on disk accesses). The worksheet is 9,999 rows by 256 columns and the program runs all *1-2-3*, Release 1A, macros and functions. *Words & Figures* worksheet files have .WKS extensions, so you can share files with *1-2-3*.

Lifetree Software describes the word processor as executive class, but I think it is subpar. Editing large documents is cumbersome; blocking and moving text is slow. The text editor is WYSIWYG, with automatic reformatting and editing commands issued *1-2-3*–style or through function keys.

An Alt-F10 combination switches between the spreadsheet and editor. As you scroll through either module, data entered in the worksheet is always treated like a spreadsheet cell; text entered in the word processor is treated like a document.

Words & Figures *lets you insert a "live" worksheet into a word processing document; editing commands are accessed by a* 1-2-3*–like /command.*

Spreadsheet ranges within the word processor are called viewports; the cells in the viewport are live, so any values or formulas changed are updated in the worksheet. When the cursor moves into the viewport the command line offers spreadsheet commands; scroll into the text and the commands are strictly for word processing.

If you need to annotate spreadsheets, *Words & Figures* will be a real timesaver.

PC MAGAZINE FACT FILE

***Words & Figures***
Lifetree Software Inc.
411 Pacific St.
Monterey, CA 93940
(800) 543-3873
**List Price:** $195
**Requires:** 256K RAM, two disk drives, DOS 2.0 or later.
**In Short:** A two-dimensional program, integrating a *1-2-3*, Release 1A, clone with a word processor. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

# R&R: A Shortcut to Creating dBASE Reports, Mailing Lists

HANDS ON

BY GLENN HART

The report generators included in *dBASE*'s several versions have been limited. *dBASE III Plus* made some improvements, but you still need to learn the complex *dBASE* programming language to create many reports. The *R&R Relational Report Writer* is a report generator with more flexibility.

*R&R*'s user interface is similar to *1-2-3*'s, with horizontal menus and messages at the top of the screen. Pop-up windows appear occasionally to display available options. A comprehensive interface is needed because *R&R* has nine command groups, with over 40 individual commands and over 60 predefined functions.

*R&R* suggests you construct what it calls a "composite record" before defining a report. The composite record is made up of all the fields in various *dBASE* data files, which you relate with *R&R*'s flexible linkage system.

You define reports by painting the positions of headers, footers, body lines, and summaries on the screen. Simple commands help you move things around to your liking. You can specify printer attributes for any field, format each field, and more. *R&R* can produce columnar or multiline reports and has an unusually flexible mailing label system.

*R&R* has excellent provisions for sorting and grouping records, creating calculated and total fields, and building English-like queries to select subsets of your data.

*R&R* isn't a code generator, and it doesn't create report definitions in the *dBASE* language. You need either *R&R* itself or an abbreviated run-time version to execute reports. You can call *R&R* from within *dBASE* with *dBASE*'s Run command if you have enough memory.

My first impression of *R&R* was that it seemed overly complex. *R&R* worms its way into your affections very quickly, though. Once I became familiar with the interface and its options, I was quickly producing complex reports that would have taken a lot of time to program manually.

*R&R* is a powerful tool that's executed beautifully, and its price is eminently fair. It's probably a bit intimidating for real tyros or clerical staff, but if you're an experienced *dBASE* user you'll love it.

PC MAGAZINE FACT FILE

***R&R Relational Report Writer***
Concentric Data Systems Inc.
18 Lyman St.
P.O. Box 4063
Westborough, MA 01581
(800) 325-9035
**List Price:** $99
**In Short:** A powerful *dBASE* report generator. Not copy protected.

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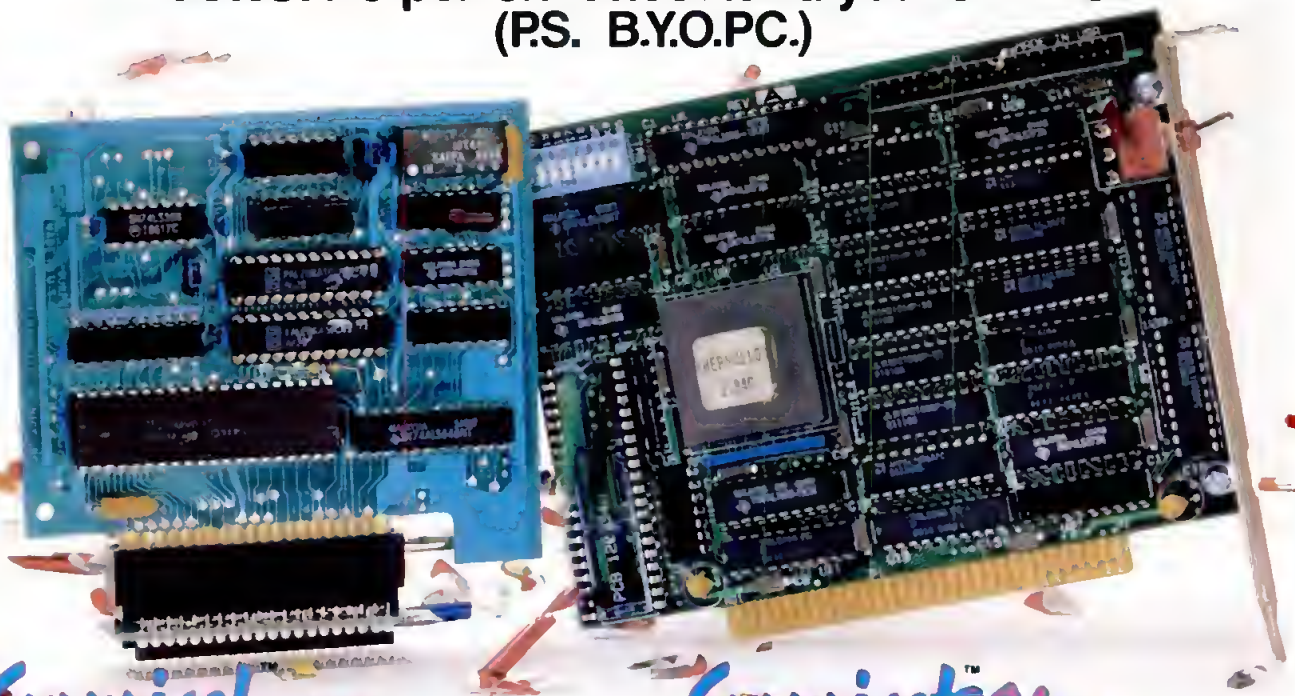

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C.ITOH
CIE Terminals

**CIE Terminals, Inc.**
**2505 McCabe Way, Irvine, CA 92714**
**Telephone: (714) 660-1421 (800) 624-2516**

CIRCLE 348 ON READER SERVICE CARD

# Super PC-Kwik Gives Lightning A Good Run for the Money

HANDS ON

BY STEPHEN RANDY DAVIS

Just as turbo cards are flourishing among PC speed-lovers who are willing to give up an expansion slot or tamper with their processor to heighten their machine's performance, a flurry of new programs offers faster PC performance by using a software cache. Multisoft Corp. is entering this fray with *Super PC-Kwik*, which the company calls the "disk accelerator."

At $79.95, the program undercuts the current champ, Personal Computer Support Group's *Lightning*, by $10.

*PC-Kwik* does not actually increase the rate at which your disk drives are working; it improves the effective disk performance through a caching technique (which, simply put, involves storing some data in a memory buffer, thereby avoiding a disk access whenever this data is called).

At boot-up you instruct *PC-Kwik* to set aside some RAM memory for the cache, into which the most recent disk sectors accessed are saved. This "sleight of disk" is transparent to all applications routines. In one sense, the cache is like a safe RAMdisk; data is loaded in memory for fast access, but because the cache program writes the data you want saved to disk at the same time, you will not lose any data when the power's turned off.

I tested the program using PC Labs benchmark tests and found the speed improvements impressive. Sequential file and random file access times improved by up to 250 and 400 percent, respectively, over unimproved DOS. When the cache size exceeded the size of the files being manipulated, the resulting performance was almost on a par with that of a RAMdisk—an 800 percent improvement in my tests. These times are similar to the results with other disk-caching programs.

*PC-Kwik* can use up to 600K bytes of conventional or 1 megabyte of extended or expanded memory (it won't conflict with Lotus/Intel/Microsoft (LIM) expanded memory specification, so you can allocate some of your expanded memory to a cache and continue to use expanded memory).

The details of *PC-Kwik*'s operation are controlled by a large number of hardware settings at installation time, but *PC-Kwik* is merciful: it examines your hardware on its own and sets the parameters to the optimum settings automatically.

Disk caching is truly effective only with hard disks. Multisoft does not warrant *Super PC-Kwik* to perform on removable platter Winchesters or on hard disks with capacities greater than 32 megabytes, though an upgrade should support partitioned hard disks. PC

## How Caching Programs Work

A caching program monitors DOS interrupts for disk accesses.

When the program intercepts a disk-read interrupt (interrupt 25), it first checks the table of disk sectors that it maintains to see if the requested disk sectors are already in the cache. If they are, the program supplies the data, saving a time-consuming disk access.

If the cache doesn't have the data, DOS is allowed to read the disk, and the caching program saves the sectors accessed (as well as the remainder of the sectors on that track) into the cache.

The caching program also monitors write-to-disk interrupts (interrupt 26) and checks its table for the information to be written.

DOS uses its own small buffers to improve read and write times; each 512-byte buffer stores as much of a recently accessed file as will fit. The default number of buffers is two (three on an AT), but you can increase the amount with the line "buffers = *x*" in your CONFIG.SYS file. DOS allows up to 99 buffers, but 20 to 30 are commonly used.

The method a good caching program uses to search its cache is much faster than the search DOS uses, especially for large buffers. And, since DOS buffers cannot be extended past 512 bytes, their usefulness is severely limited. —Mitt Jones

## PC MAGAZINE FACT FILE

***Super PC-Kwik***
Multisoft Corp.
18220 SW Monte Verdi Blvd.
Beaverton, OR 97007
(503) 642-7108
**List Price:** $79.95
**Requires:** 128K RAM, DOS 2.0 or later.
**In Short:** Increases file accesses by caching memory. Not copy protected.

CIRCLE 423 ON READER SERVICE CARD

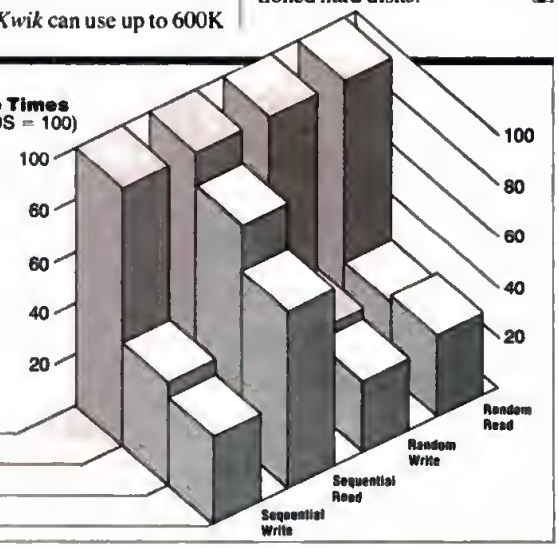
## PC LABS Benchmark Tests: Super PC Kwik vs. Lightning and DOS 3.1

The differences between the two cache programs, *Super PC Kwik* and *Lightning*, would hardly be noticeable under normal operation. But both cache programs give a dramatic improvement over DOS.

The **File Access** benchmark test measures the time it takes to create and sequentially write a 256K-byte data file using record lengths of 512 bytes. The test program then performs a series of operations: a sequential overwrite, a sequential read of the same file, followed by a random overwrite and random read. This test was run on an IBM PC with a 20-Mbyte hard disk; buffers were set at 4 on both cache programs and at 90 when running DOS 3.1 unimproved.

**Performance Times**
(Times given in seconds)

| Product | Sequential Write | Sequential Read | Random Write | Random Read |
|---|---|---|---|---|
| DOS 3.1 | 27.63 | 12.50 | 50.00 | 41.00 |
| Super PC Kwik | 11.14 | 10.93 | 15.96 | 12.07 |
| Lightning | 9.73 | 8.74 | 14.31 | 13.32 |



## ■ NEW ON THE MARKET ■ JONATHAN K. MATZKIN

### New 80286-Based Micro: 12 MHz, No Wait States

The latest fast 286-based machine is **PC Designs'** 6/12-MHz GV-286, which costs $3,799 with monochrome adapter and monitor.

PC Designs claims that a static 32K-byte 45-nanosecond RAM cache circuit allows reliable no-wait-state operation at 12 MHz. Users can toggle the cache and the clock speed from the keyboard.

PC Designs says the I/O bus timing of the GV-286 is identical to that of the 8-MHz IBM PC AT. That makes for maximum compatibility with expanded memory, network interfaces, and other existing add-on boards. PC Designs designed and manufactures the motherboard used in the GV-286.

**List Price:** GV-286, $3,525 with a 360K or 1.2-Mbyte floppy disk drive, a 30-Mbyte hard disk with 60 Mbytes of streaming cartridge tape backup, and 1 Mbyte of RAM; $3,799 with a Princeton Graphics Max-12 monochrome monitor and a monochrome graphics display card. PC Designs Inc., 2500 N. Hemlock Circle, Broken Arrow, OK 74012; (918) 251-5550.

CIRCLE **433** ON READER SERVICE CARD

### HP Expansion Board Brings Full-Page Graphics to Laserjet

**Hewlett-Packard Co.** has introduced the HP 2-megabyte, $2,495 upgrade kit, which enhances the graphics, page layout, and multiuser capabilities of the HP Laserjet printers. The kit replaces the printer's main interface board and provides 2 megabytes of memory.

With the upgrade package, the Laserjet, Laserjet Plus, and Laserjet 500 Plus printers print full-page, 300-dot-per-inch graphics.

The new board incorporates the HP printer command language and is compatible with more than 500 software programs that support the Laserjet line. Some programs, including *Microsoft Windows* and *PFS:Graph*, have been revised to exploit the expanded memory and graphics capabilities of the new board.

**List Price:** HP 2-megabyte upgrade kit, $2,495. Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303; (800) 367-4772.

CIRCLE **438** ON READER SERVICE CARD

### 3½-Inch Floppy Drives From Toshiba, Maynard Bridge Laptop and Desktop

**Toshiba America** and **Maynard Electronics** have introduced 3½-inch disk drives that let desktop PCs share files with laptop models. Desktop machines can also use the 720K-byte disk drives for their own purposes. Toshiba's ND354A disk drive and installation kit, $150, is designed for IBM and compatible computers. The disk drive is compatible with both the IBM PC Convertible and the Toshiba T3100, T1100, and T1100 Plus laptops.

Maynard's 3½-inch floppy disk drive is available in both internal and external versions for the PC and XT and in an internal version for the AT. The $250 internal disk drive fits a regular half-height floppy disk bay. The external model, for $350, includes an 11-watt power supply, so it draws no power from the computer.

**List Price:** Toshiba ND354A disk drive and installation kit, $150. Toshiba America Inc., Information Systems Div., 2441 Michelle Dr., Tustin, CA 92680; (714) 730-5000.

CIRCLE **442** ON READER SERVICE CARD

**List Price:** Maynard internal 3½-inch drive kit, $250; external/portable drive, $350. Maynard Electronics, 460 E. Semoran Blvd., Casselberry, FL 32707; (305) 331-6402.

CIRCLE **443** ON READER SERVICE CARD

## HOT PROSPECT

### Lotus's Manuscript: Word Processing For Scientists and Engineers

Technical professionals strain the capabilities of most word processors. **Lotus Development Corp.'s** $495 *Manuscript* is designed for engineers and scientists who create long, frequently revised reports, specifications, and proposals.

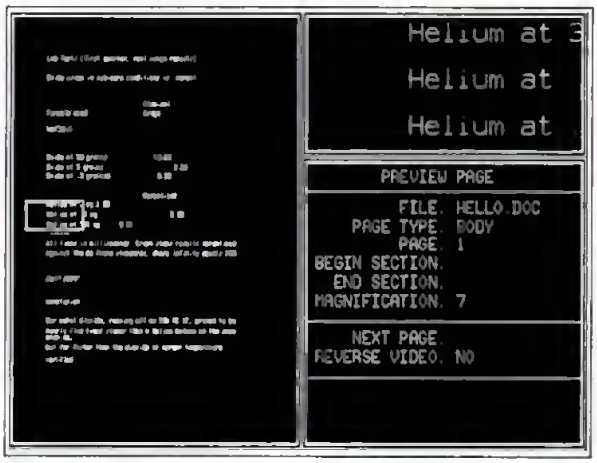
*Manuscript* supports equations and mathematical symbols and imports worksheet data from *1-2-3* and *Symphony*. Pictures and diagrams input from scanners can be sized and placed anywhere on the page.

*Manuscript* also incorporates traditional word processing features such as cut and paste, search and replace, and form-letter generation. It provides advanced table handling, a built-in structured outliner, global indexing and footnoting, a spelling checker, and a document-comparison feature that highlights revisions. Document preview displays a document as it will appear when printed.

*Manuscript* currently supports 35 printers, as well as Adobe Systems' PostScript page description language.

**List Price:** *Manuscript*, $495. **Requires:** 512K RAM, hard disk, DOS 2.0 or later. Not copy protected. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.

CIRCLE **432** ON READER SERVICE CARD




*Lotus's feature-laden word processor* Manuscript *includes a page-preview display with a box that zooms in on a selected window.*

### New Graphics Adapter Displays EGA Software On Any PC Monitor

**ATI Technologies** says that its $399 EGA Wonder graphics adapter, displays EGA, CGA, MDA, Hercules, and 132-column software on any PC-compatible monitor.

Practically speaking, that

*ATI Technologies's $399 EGA Wonder lets users run EGA software on any PC-compatible monitor*

## Four Companies Aim for High End of Dot Matrix Market

Four companies have introduced printers that generate fast, high-quality output—for a price.

**C. Itoh Electronics** claims the $1,995 Model 9815 prints at 333 characters per second in 10-character-per-inch draft mode and 135 cps in 10-pitch letter-quality mode. Resolution is 180 by 360 dots per inch. Aside from speed, the printer offers user-programmable font cartridges and a 136-column width.

The $1,695 Pinwriter, Model P9XL, from **NEC Information Systems**, prints at 330 cps in 10-cpi draft mode and 140 cps in 12-cpi letter-quality mode, NEC says. The P9XL offers resolution of 360 by 360 dots per inch and 16 resident type fonts. Other features include a 16K-byte receive buffer and eight-color printing capability using a four-color ribbon. NEC reports an acoustic rating of 55 decibels in "quiet" mode.

**Toshiba America**'s $1,599 P351, Model 2, prints at 250 cps in 10-pitch draft mode and 100 cps in letter-quality mode, the company claims. Print quality, font, pitch, paper motion, and quiet mode are selectable at the unit's front panel. Standard emulations include the Qume Sprint 11 daisy wheel and the IBM Graphics Printer. The Model 2's printhead uses a 36- by 42-dpi matrix to generate letter-quality characters.

*Toshiba's $1,599 P351, Model 2, offers front-panel selection of print quality, font, pitch, paper motion, and "quiet" mode.*

Unique paper-handling capabilities are a selling point for the $2,445 Juki 7200 from **Juki Office Machine Corp.** The printer features both front- and rear-loading capability, the company says, and allows alternation between continuous and cut-sheet feeding without paper removal. Juki claims print speed of 270 cps in 10-pitch draft mode and 90 cps in 10-pitch letter-quality mode. The 7200 comes with 7K bytes of memory, expandable to up to 15K bytes. There is also a 64K option.

**List Price:** Model 9815, $1,995. C. Itoh Electronics, 19300 S. Hamilton Ave., Torrance, CA 90248; (213) 327-9100.

CIRCLE **434** ON READER SERVICE CARD

**List Price:** Pinwriter, Model P9XL, $1,695. NEC Information Systems Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; (617) 264-8000.

CIRCLE **435** ON READER SERVICE CARD

**List Price:** P351, Model 2, $1,599. Toshiba America Inc., Information Systems Div., 2441 Michelle Dr., Tustin, CA 92680; (800) 457-7777.

CIRCLE **436** ON READER SERVICE CARD

*The Juki 7200, $2,445 from Juki Office Machine Corp., allows alternation between continuous and cut-sheet feeding without paper removal*

**List Price:** Juki 7200, $2,445. Juki Office Machine Corp., 20437 Western Ave., Torrance, CA 90501; (800) 325-6134.

CIRCLE **437** ON READER SERVICE CARD

## Lotus Sells CD-ROM–Based Financial Database With Weekly Updates

**Lotus Development Corp.** has initiated *One Source*, a CD-ROM system that incorporates new and existing software products. Intended for financial managers, the system has historical financial databases delivered on CD-ROMs and analysis software, including *Lotus Financial* and *Microscan*.

Lotus says that the CD-ROM technology brings the largest financial databases—currently available in complete form only on mainframes—to the desktop. *Lotus Financial* is an extension to *1-2-3* that accesses financial data on CD-ROM disks from within the *1-2-3* spreadsheet.

Users of *One Source* can create custom applications or use a provided library of prepackaged reports. Among the databases available is the Daily Stock Price History, which covers more than 25,000 issues and 3 years of time-series data. Also offered are Compustat, Value Line, Bonds, I/B/E/S, Ford Investor Services, Financial Post, and Disclosure II databases.

The system includes daily electronic updates and weekly updates issued on CD-ROMs.

**List Price:** *One Source*, $11,000 to $27,000 per year, depending on system configuration. **Requires:** 640K RAM, 10-Mbyte hard disk, XT or AT, *1-2-3* (Release 2.0 or 2.01). Not copy protected. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.

CIRCLE **444** ON READER SERVICE CARD

means users can upgrade to EGA software without incurring the considerable expense of an EGA monitor.

EGA Wonder senses and automatically switches between EGA and CGA color modes, or between MDA, Hercules, and EGA monochrome modes.

No mode commands, special software, or pre-boot drivers are required.

When running CGA software on an EGA monitor, EGA Wonder displays high-resolution (8-dot by 14-dot) text. CGA software normally provides 8 by 8 text. CGA graphics are double scanned, for higher image quality, when using the EGA Wonder.

If used with both EGA software and an RGB monitor, EGA Wonder displays both high-resolution text and high-resolution graphics.

**List Price:** EGA Wonder, $399. ATI Technologies Inc., 450 Esna Park Dr., Markham, Ontario, Canada L3R 1H5; (416) 477-8804.

CIRCLE **439** ON READER SERVICE CARD

## ROM BIOS–Maker Phoenix Debuts First Software: Disk Utility Package

**Phoenix Technologies**, supplier of ROM BIOSs and other essentials of PC compatibility to compatible makers, has debuted its first-ever software package. *Pdisk*, at $195, integrates ten hard disk management utilities into a single package.

Among *Pdisk*'s features is a backup/restore program for transfer of data between hard disks and floppy disks or any other DOS-driven device, including nine-track tape drives, optical disks, and cartridges. Also included is a park utility that shuts down the hard disk when the PC is moved, reducing the likelihood of information loss, as well as a cache program. Rounding out the package are six DOS utilities that simplify file management.

**List Price:** *Pdisk*, $195. Phoenix Technologies Ltd., 320 Norwood Park South, Norwood, MA 02062; (617) 769-7020.

CIRCLE **445** ON READER SERVICE CARD

# Tops Links Mac and PC Files for Less than $400 per Station

PC HANDS ON

BY HOWARD MARKS

There's now a simple, inexpensive way to get a PC and an Apple Macintosh to share data files—and it's more convenient than modem or direct serial connections. Centram Systems West has produced the first local area network that allows PCs and Macs to share data without the use of a dedicated file server. Tops makes this link at a reasonable cost and without the need for complicated cables or commands.

Installing and using Tops is very easy. After inserting an interface board in the PC and hooking up the cables, installation of the menu-driven software takes only about 10 minutes per machine.

Tops loads as a combination device driver and memory-resident program taking 280K bytes of memory in each station.

## Menu-Driven Interface

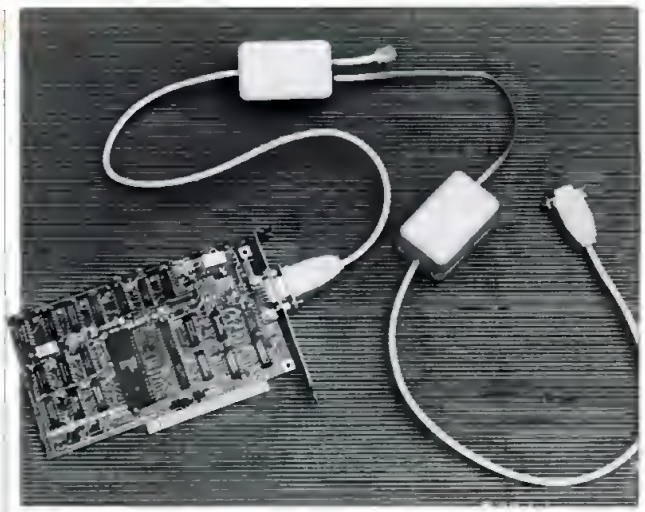
Using Tops is also a simple, menu-driven process. To allow others to access your word processing directory, for example, all you have to do is publish it (through a menu option) by giving it a name that others can use to call it; use of a password is optional.

Published directory names are listed in the Tops menu. To call up one from another station, you simply select it from a list of menu choices and assign a drive letter, based on the disk you want to work from on your own system.

From that point on, you can use files on the published directory as if it were another disk drive. A Mac station can publish the volumes it wants to open to the network and it can access PC directories as if they were Mac volumes.

## Memory-Resident Menu

The Tops menu is memory-resident in each computer; when one node requests a directory, the Tops software looks at each node's currently published directory. If the directory is listed there, you pick the directory and look for a file; Tops will take care of the file transfer.



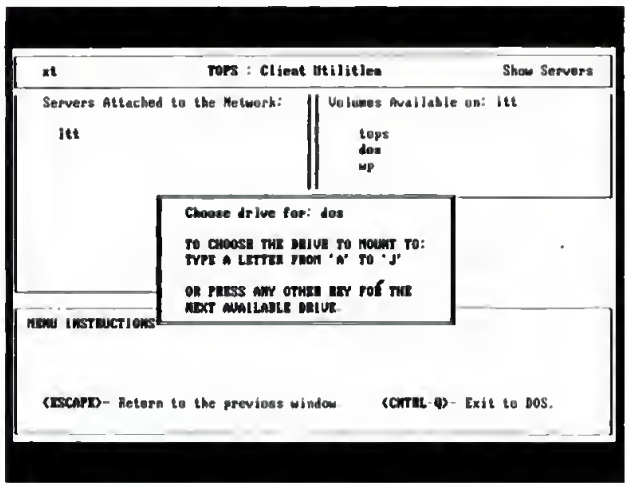
*The Tops adapter card for the PC connects to a PhoneNET cable and adapter, which runs off ordinary phone wire in linking with an Apple Macintosh.*

Because the list of published directories is stored in a RAM-resident program, it's possible to lose your published list at power down; however, Tops gives you the option of saving your list whenever you choose. This gives you the flexibility to make directories (or Mac volumes) available or closed on a temporary basis.

Tops does not require that a PC be dedicated to providing file service for the other stations. Tops is a peer network: all stations are equal. All of them can publish directories and use published directories on other stations.

At $389 for the PC or $149 for the Mac, Tops' perfomance is in line with its price. In a network of PCs, Tops transmits data at 800K bits per second; the speed drops down to the Appletalk rate of 230K bps when a Mac is connected to the network (the highest rate for PC RS-232 LANs is currently about 60K bps). Tops uses Appletalk cables or compatible cable systems, such as PhoneNET, that make it possible to use regular telephone wire for your network.

Although Tops does not provide the speed or some of the features of high-performance (and high-cost) LANs, its ease of use and ability to share files between Macintoshes and PCs make it an important addition to the market. PC




*Memory-resident software gives each PC access to all the files that every linked Mac or PC has posted for public consumption on the network.*

## PC MAGAZINE FACT FILE

**Tops for the PC**
**Tops for the Macintosh**
Centram Systems West Inc.
2560 9th St.
Berkeley, CA 94710
(415) 549-5900
**List Price:** $389 per PC; $149 per Mac.
**Requires:** Tops for the PC: 384K RAM; Appletalk, PhoneNET, or similar cables; DOS 2.1 or later (DOS 3.1 required for record locking). Tops for the Macintosh: Macintosh 512K or Macintosh Plus; Appletalk, PhoneNET, or similar cables.
**In Short:** A low-cost LAN allows PCs to share disk data with other PCs and Macintoshes and share Apple LaserWriter and ImageWriter II printers.

CIRCLE 426 ON READER SERVICE CARD

**PhoneNET**
Farallon Computing
1442A Walnut St., #64
Berkeley, CA 94709
(415) 849-2331
**List Price:** $49 each
**In Short:** Adapters to allow Appletalk protocols to be used on standard telephone cable with modular connectors at the same time the cable carries telephone signals; one connects to the PC, the other connects to the phone cable.

CIRCLE 427 ON READER SERVICE CARD

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CIRCLE 300 ON READER SERVICE CARD

■ QUICK LOOKS ■

# Hotshot Annotates Text-Only Screens

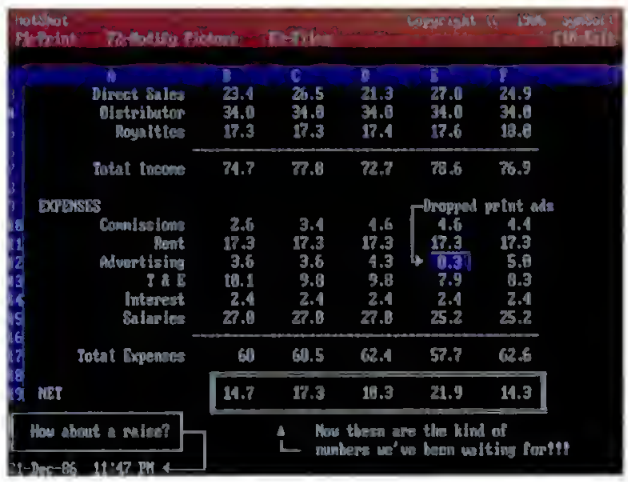
PC HANDS ON

BY STEVE SAGMAN

For simple jobs, Symsoft's new *Hotshot* RAM-resident screen-capture and enhancement program is an easy alternative to running graphics software when you need to add notes to a text screen.

*Hatshot* generates on-screen text, lines, boxes, arrows, and shading. It pops up over any text-based program (it won't work in graphics mode) and gives you an immediate screen copy to work with.

You can modify the screen as much as you'd like and save it to disk or print an exact image in one of three sizes with a dot matrix or laser printer.




Hotshot *lets you add comments to your applications text screens for printing or for sharing with other* Hotshot *users.*

*Hotshot* shines at quickly annotating another application's display, such as a screenful of a *1-2-3* spreadsheet.

The program coexisted with every text-based program I tried, and it generated a crisp printout. At $99.95, it's a little expensive, but it's the kind of simple tool you may use if you need to add comments to your applications.

**List Price:** *Hatshat*, $99.95.
**Requires:** 256K RAM, one disk drive, DOS 2.1 or later. Not copy protected. Symsoft, P.O. Box 4477, Mountain View, CA 94040; (415) 962-9500.

CIRCLE **448** ON READER SERVICE CARD

# Freeform: Simple CGA Graphics

PC HANDS ON

BY STEVE SAGMAN

Artech Software's new CGA-only *Freefarm* is an icon-based paint program that allows you to draw on-screen with a mouse, much like *PC Paintbrush* and *Dr. Halo II*. *Freefarm*'s main selling point is its ability to draw 3-D objects and text with perspective so that they appear to extend into the distance. The 3-D effect requires a math co-processor and is really only a shading effect, not a truly useful perspective on depth.

*Freeform* supplies the standard list of paint program features such as drawing, moving, and filling circles, arcs, lines, and polygons, but it does these no better than other inexpensive graphics programs.

The 3-D–like perspective can dramatically enhance a picture, but mastering *Freeform*'s perspective capabilities is difficult, and the results may not be worth the effort. For example, you can choose the degree of depth your objects will have, but only on a scale of 1 to 10.

In addition, *Freefarm* restricts your drawing in 3-D to the middle of the screen. If you want your object to appear at any other screen location, you must save it to a file and then retrieve it at that point.

If you need to enhance charts and graphs with an extra dimension, programs like *Perspective*, *Energraphics*, and *GEM Graph* are better choices. *Freeform* is more suitable for free-hand drawing.

Only a few text fonts come with the package, and most look ill-formed in general and worse when drawn in 3-D. *Dr. Halo II*, even though it draws in flat 2-D only, provides more and better-looking fonts and offers greater control of text size and placement.

Another *Freeform* selling point is its slide-show capability, which simply strings together a series of frames. You'll have to buy an additional presentation package from Artech for special effects, such as dissolves between frames.

**List Price:** *Freefarm*, $149.95.
**Requires:** 320K RAM, one disk drive, color/graphics card, DOS 2.0 or later. Mouse or digitizing tablet recommended. Not copy protected. Artech Software, P.O. Box 2847, Reston, VA 22091; (703) 860-3085.

CIRCLE **447** ON READER SERVICE CARD

# ColorMagic Dresses Up EGA Screens

PC HANDS ON

BY JON PEPPER

*ColarMagic* is an absolute jewel of a utility program that puts you in total control of the screen colors generated by an Enhanced Graphics Adapter. When used with an Enhanced Color Monitor, *ColorMagic* lets you reassign any default screen color to a substitute color from the EGA's nominal limit of 64 colors. It's easy to use, inexpensive, and will earn its keep every time you turn on your system, if you enjoy the benefits that color can bring to a screen.

The program resides in low memory (using less than 1K byte of RAM) and intercepts the keyboard to select a remapped palette. You can choose from 15 predefined palettes or create up to 48 palettes of your own definition. One part of the screen shows the standard IBM colors, while the adjacent column lets you scroll through the possible substitute colors. When you find one you like, you press Enter to lock it in and then continue substituting for as many of the standard colors as you wish.

*ColarMagic* offers the seven basic hues at 16 levels of intensity to produce up to 112 color variations. You can store custom palettes for each of your applications, if you wish, and toggle between your new selections and the standard ones by pressing Ctrl-F2. *ColorMagic* worked beautifully with the most popular applications software and should be standard issue with any EGA card.

**List Price:** *Color Mogic*, $39.95.
**Requires:** 128K RAM (resides in 1K of RAM), EGA card, DOS 2.0 or later. Not copy protected. Lifetree Software Inc., 411 Pacific St., Monterey, CA 93940; (408) 373-4718.

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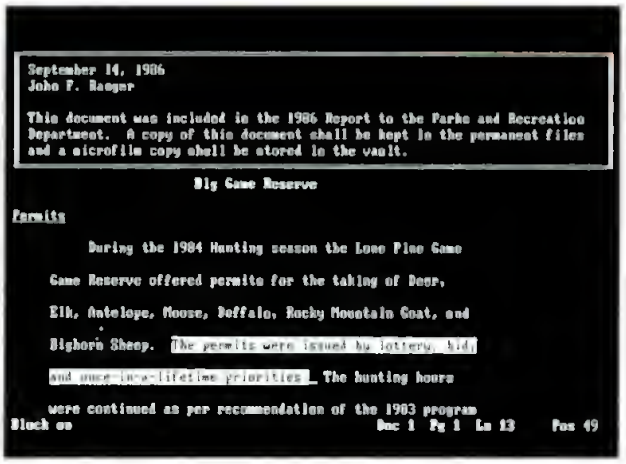
## ■ PC UPDATE ■ PEGGY GAVAN




*WordPerfect, Version 4.2, has more than 30 new features, including support for Adobe Systems' PostScript language and a document-summary function*

***WordPerfect***, Version 4.2, adds more than 30 new features, including support for PostScript, a document-summary function, and an expanded thesaurus. In addition, medical, legal, scientific, and technical terms have been added to the spelling dictionary, and hyphenation is now automatic. Registered users can upgrade for $35. WordPerfect Corp., Orem, Utah; (801) 227-4005.

* * * * *

The Lattice MS-DOS ***C Compiler***, Version 3.2, supports *Microsoft Windows*, generates more than 64K bytes of static data, and supports ROM-based applications using the "const" data type. Registered users of Versions 3.0 or 3.1 will receive Version 3.2 at no charge; users of Version 2.5 or earlier can upgrade for $75. Lattice, Glen Ellyn, Ill.; (312) 858-7950.

* * * * *

Datacopy has upgraded its ***OCR*** and ***OCR Plus*** software products and enhanced its ***Word Image Processing System*** (*WIPS*) software. New features added to the OCR product line include support for proportionally spaced fonts and variable-size characters. Upgrades are $50 for registered users. *WIPS* now supports *PC Paintbrush* and Datacopy's .IMG image file structure, and upgrades are free. Datacopy, Mountain View, Calif.; (415) 922-2141.

* * * * *

Okidata is bundling ***LaserControl***, a $150 software product that emulates several dot matrix and daisy wheel printers, with every *Laserline 6* laser printer it ships by March 31, 1987. The software emulates IBM, Epson, Diablo, Okidata Microline, and Qume printers. Okidata, Mt. Laurel, N.J.; (609) 235-2600.

* * * * *

A major enhancement to ***XyWrite III***, Version 3.1, is a page-layout capability that automatically varies the leading, or spacing, between lines and paragraphs, so you have more power in your formatting. Several other added features enhance hard disk work, such as a Find command that searches for files across all subdirectories and a Tree command that displays all subdirectories on a particular drive. Upgrades are $35 for registered users of earlier versions of *XyWrite III*, $100 for *XyWrite II Plus*, and $200 for *XyWrite II*. XyQuest, Bedford, Mass.; (617) 275-4439.

* * * * *

Generic Software has added a new productivity module, *Drafting Enhancements-1*, to its ***CADD***, Version 2.0, package. The $49.95 module features geometric snaps, utilities for trimming and extending entities, filleting, and chamfering. Generic Software, Redmond, Wash.; (800) 228-3601.

Hewlett-Packard Co., Aldus Corp., and Microsoft Corp. are combining resources to market a number of products together as a complete desktop publishing solution. HP is bundling Aldus's soon-to-be-released PC version of ***PageMaker*** software, HP's version of

*Hewlett-Packard is bundling its Vectra AT with Aldus Corp.'s* PageMaker *and* Microsoft Windows *as part of a marketing alliance for desktop publishing.*

***Microsoft Windows***, and an **HP Mouse** with its **Vectra AT** personal computer. The complete package, called the Vectra Publisher AT, is $5,829 if purchased with a monochrome monitor or $6,719 with an EGA monitor. Hewlett-Packard Co., Boise, Idaho; (208) 323-3869.

* * * * *

**In brief:** MicroPro International Corp. has acquired New Star Software's ***NewWord*** product base, including *NewWord2* and *NewWord3*. The company is also bundling its *Easy* word processing package with Aquarius Systems' PC-compatible computer. MicroPro International Corp., San Rafael, Calif.; (415) 499-1200...Digital Research has upgraded ***GEM Draw*** to ***GEM Draw Plus***. The new version includes a run-time version of ***GEM***, allowing it to run as a standalone application. Digital Research, Monterey, Calif.; (408) 649-3896...**Clarion**, Version 1.1, adds 15 enhancements, including a Converter utility for importing/exporting DIF, *dBASE II*, *dBASE III*, and BASIC files, and free run-time modules to support Clarion-based applications. It no longer requires the presence of a hardware copy-protection device. Registered users can upgrade for $100. Barrington Systems, Pompano Beach, Fla.; (305) 785-4555 ...***Software Bridge***, Version 2.0, adds file-conversion capability for *Microsoft Word* and *Volkswriter*. Upgrades are $49. Systems Compatibility Corp., Chicago, Ill.; (312) 329-0700...Version 1.1 of Persoft's ***SmarTerm 240*** communications/terminal-emulation package has an optional $50 network kit for Ungermann-Bass's *NET/One* and Bridge Communications' *EtherTerm* network support. In addition, the new version also features support for EGA high-resolution graphics. Upgrades are $50. Persoft, Madison, Wis.; (608) 273-6000. PC

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# Quicksilver Does Fair Job at dBASE Applications Compiling

HANDS ON

BY GLENN HART

*Quicksilver*, a new compiler with *dBASE III Plus* compatibility, is really an outgrowth of Wordtech's popular *dBASE*-compatible pseudo-compilers, *dB/Compiler* and *dBIII/Compiler*. This new product can live without the shame of having *pseudo* tacked onto its description: *Quicksilver* sheds the interpreter and compiles fully executable code.

Nantucket's *Clipper* compiler has traditionally enjoyed more success than *dBIII/Compiler*, largely because it executed faster. In the transition, *Quicksilver* has succeeded in catching up with *Clipper*'s speed, but in the meantime *FoxBASE Plus* has established that program as the fastest *dBASE* compiler of all (for review, see First Looks, page 46, *PC Magazine*, Volume 5 Number 21).

While Wordtech's compilers have always offered certain advantages, *dBASE* developers compile their applications primarily for greater speed.

I found *Quicksilver* to be reasonably compatible with *dBASE III Plus*, but there are some unsupported commands and niggling differences in the basic syntax. These discrepancies block many *dBASE* applications from running under *Quicksilver* without some modifications.

*Quicksilver* includes some major extensions of the *dBASE* language that are useful and well done. The most notable is a very powerful and flexible windowing system. A rich set of commands lets you establish up to 99 windows of various sizes and colors that you can move, expand, contract, and overlay.

You can define your own functions with *Quicksilver*'s user-defined function mechanism, which is much more powerful than simple parameter passing in *dBASE III Plus*. Your functions are stored in separate function files, which you can compile and access from other programs.

Like its predecessors, *Quicksilver* has an excellent symbolic debugger. It's complex and takes a while to learn, but there's nothing as powerful in the *dBASE* community.

Wordtech offers a networking option that both is compatible with *dBASE III Plus* and goes several steps further. *Quicksilver* can manage many (but not all) file- and record-locking situations automatically, without extensive recoding. The LAN server software costs $99 and, regardless of the number of workstations connected, one copy is required per server.

To get an idea of *Quicksilver*'s speed, I ran some sample reports. The first report ran as is, but I had to modify the second because of *Quicksilver*'s limited implementation of the Sort command.

Both test reports ran faster than *dBASE III Plus* when processed through the *Quicksilver* compiler and linker. Optimizing the programs and linking with the Microsoft DOS linker improved times. The optimized versions ran about as fast as *Clipper*, a real advance for Wordtech. The new *FoxBASE Plus* beat them all.

The third-party *dBASE* market is heating up. The new *FoxBASE Plus* looks great and an improved *Clipper* from Nantucket is imminent. Meanwhile, *Quicksilver* looks like a good product that performs well.

## dBASE-Compatible Compiler Speed Test

| | Report 1 | Report 2 |
|---|---|---|
| FoxBASE+ | 0:26 | 1:01 |
| Clipper | 0:46 | 1:46 |
| Quicksilver | 0:46 | 1:56 |
| dBASE III Plus | 1:25 | 3:34 |

*Timing the same two reports that were generated under* dBASE III Plus *and compiled under* FoxBASE+, Clipper, *and* Quicksilver, *shows that* FoxBASE+ *is significantly faster than its two main competitors.* Quicksilver*-compiled reports run about twice as fast as if they were run under* dBASE III Plus, *without compiling.*

PC MAGAZINE FACT FILE

***Quicksilver*, Version 1.0**
Wordtech Systems Inc.
P.O. Box 1747
Orinda, CA 94563
(415) 254-0900
**List Price:** $599
**Requires:** 256K RAM
**In Short:** A competent *dBASE III Plus*-compatible compiler. There are some *dBASE* syntax incompatibilities. Its best feature is screen generation.

CIRCLE 430 ON READER SERVICE CARD

# ForComment Tracks Text Revisions

HANDS ON

BY CHRISTOPHER JOHNSTON

Anyone who has reviewed reports and memos on a group project knows how hard it is to keep track of who made changes and who offered suggestions and why. *ForComment* from Broderbund Software can make life a little easier for anyone working on a group word processing project.

*ForComment* is a document-review utility that operates in a two-step process. First, you draft a document using your word processor. Using *ForComment*'s *1-2-3*–like menu structure, you can then load the document into the program's Author disk. Next, you create a distribution list of people who have to look at that document and write a memo that functions as a cover sheet. You can make any last-minute changes in the text itself, using search-and-replace functions.

Comments and personal notes can be written into the text itself using a window that pops onto the lower part of the screen at text level (to tell everyone, for example, if you think a certain fact needs verification). Optional passwords and security levels can be assigned to each user, depending on whether they should be allowed to see the comments of others.

Each reviewer uses a copy of *ForComment*'s Reviewer disk and the text file to be reviewed. Reviewers use the notepad win-

*(continues on page 59)*

PC MAGAZINE FACT FILE

***ForComment***
Broderbund Software Inc.
17 Paul Dr.
San Rafael, CA 94903
(415) 479-1700
**List Price:** $195
**Requires:** 256K RAM, DOS 2.0 or later. EGA recommended.
**In Short:** Document-review manager. Good for anyone who reviews word processing work. Not copy protected.

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# Lotus HAL Lets You Do More With (And Get More From) 1-2-3 Than Ever Before.

Lotus HAL™ is a memory resident companion product for Lotus 1-2-3® that enhances the full range of 1-2-3's capabilities—and adds new ones.

It increases 1-2-3's power and flexibility, so you can work more efficiently and become more productive than ever before.

## Benefits For All 1-2-3 Users

Lotus HAL works by giving you easier access to all of 1-2-3's numerous capabilities. And it's extremely useful for 1-2-3 users of all levels.

If you're new to 1-2-3, Lotus HAL will let you use it with greater confidence and speed.

If you're familiar with 1-2-3, Lotus HAL will make it easier for you to access additional power and capabilities.

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How does Lotus HAL do all this—for all users?

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Lotus HAL makes executing 1-2-3 procedures even easier than before. Because it accepts phrases like "total sales," "graph Jan to Mar," or "copy this to A10," etc. In fact, Lotus HAL's vocabulary includes English words and phrases. So you can customize a command dictionary of your own—with the words and operations you're most used to and most comfortable using.

Since Lotus HAL makes 1-2-3 more accessible for all users, you'll learn more—in less time—about all the capabilities of 1-2-3.

For instance, if you're presently using only the spreadsheet, Lotus HAL will show you how to create graphs and do database functions—far more simply than ever before.

## Time-Saving Shortcuts, Easy-To-Create Macros

With Lotus HAL, you'll take shortcuts and accomplish multi-step tasks quickly and easily. So you'll greatly reduce errors—and save time.

And, with a simple "undo" command, Lotus HAL even lets you recover from errors you've already made. So if you're a novice user, you'll learn faster and with greater confidence. And if you're an experienced user, you can experiment more freely and do "what ifs"—without fear of having a mistake destroy hours of work.

Lotus HAL also makes developing macros simpler than ever—so simple, in fact, that even novice users can create 1-2-3 macros with Lotus HAL. And no matter how familiar with 1-2-3 you are, you'll benefit from being able to write and test macros to make sure they do what you had in mind.

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Lotus HAL will let you take 1-2-3 as far as you need. And if you've been taking it far already, Lotus HAL offers you new commands that will further enhance your productivity.

For example, Lotus HAL lets you replace items anywhere in the worksheet (even within formulas), and create a dynamic link between cells in multiple worksheets. It also lets you audit your worksheet—so you can find mistakes without having to review the entire sheet "manually."

Best of all, while Lotus HAL greatly enhances 1-2-3's commands, it doesn't change either 1-2-3 or the worksheet. It's always available, but it never gets in your way. And you can share data as freely when you're using Lotus HAL as you did when you were using 1-2-3 alone.

In fact, you can do everything you've ever done with 1-2-3 even better...plus a great deal more.

And since Lotus HAL is part of the 1-2-3 system—and the Lotus family—you get an unparalleled commitment to customer service and support that will keep you up and running.

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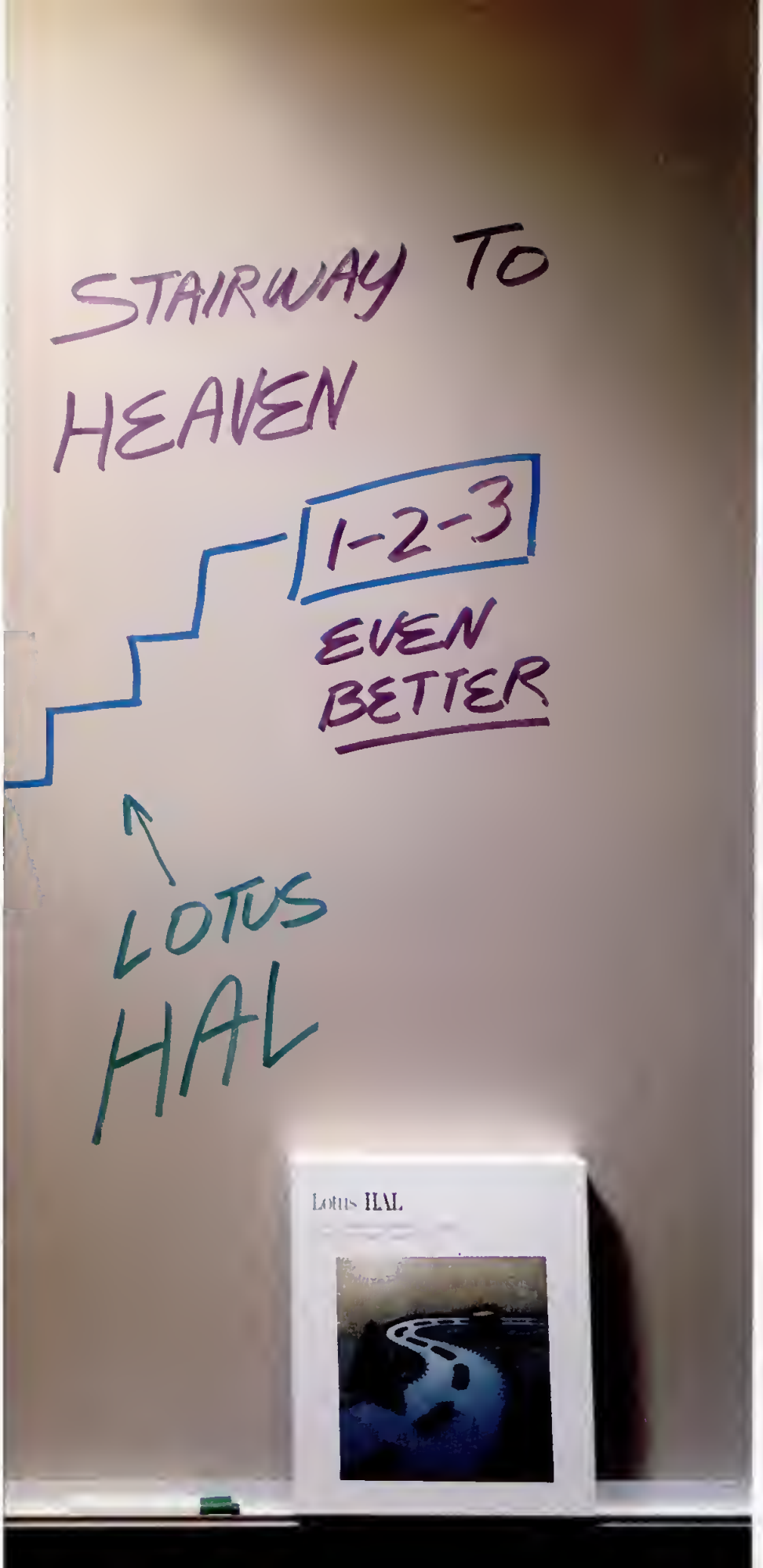
Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation. Lotus HAL and 1-2-3 Companion are trademarks of Lotus Development Corporation.
Lotus HAL is distinguished from HAL which is a trademark of Qantel for its Hotel and Leisure software.

**System Requirements.**
Lotus HAL requires 1-2-3 Release 1A, Release 2 or Release 2.01 for personal computers from IBM* COMPAQ, and AT&T, plus 1-2-3 Certified Compatibles, DOS 2.0 or higher. Please refer to your 1-2-3 package or 1-2-3 documentation for appropriate hardware configurations and DOS requirements or consult your dealer.
Lotus HAL resides in memory with 1-2-3 and operates with it; a minimum system configuration of 512K is required.
*Lotus HAL does not operate with 1-2-3 for the IBM PCjr (ROM version), IBM PC Convertible or Release 1A for the IBM 3270 PC.

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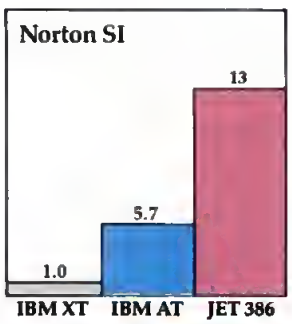


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—*Classified od*, Dallas Morning News, *October 18, 1986*

*Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to Communiqués,* PC Magazine, *One Park Avenue, New York, NY 10016; (212) 503-5293 or MCI Mail 157-9301. Contributors receive $50 and a* PC Magazine *T-shirt. Contributors this issue: Marc Friedland (printer classified).*

*At left: This ad for Open System's* Harmony *combined accounting/business software bears the caption "Until now only a few organizations have been able to link their workers."*

### Stewart Alsop's Official 1986 Vapor List

The basic definition of vaporware: products that are widely touted well before they're available for purchase. Despite their unavailability, these thinner-than-air products affect consumers' purchasing decisions. The *creme de lo vopor* not only fails to ship on time but injects confusion into an already confused marketplace.

Here are the top-ten vapor products for 1986, as compiled by *PC Magazine* West Coast editor Stewart Alsop for his newsletter, *P.C. Letter: The Insider's Guide to the Personol Computer Industry*. The blanks under the shipping date mean the products hadn't shipped as of November 1986. Announcement dates are not official dates but rather the first time the products were written about in the trade press.

| Product | Company | Announced Date | Orig. Ship Date | Actually Shipped |
|---|---|---|---|---|
| Panorama | Dynamical | 03-85 | — | 02-86 |
| StarLAN | AT&T | 03-85 | 12-85 | 03-86 |
| Crosstalk Mark IV | Microstuf | 04-85 | 06-85 | — |
| Optical drive | Verbatim | 07-85 | 12-87 | — |
| Token Ring | IBM | 10-85 | 03-86 | 03-86 |
| Tops | Centram Systems | 11-85 | 01-86 | 07-86 |
| Pagemaker (PC) | Aldus | 03-86 | 12-86 | — |
| Ventura Publisher | Xerox | 03-86 | 11-86 | 11-86 |
| Pageperfect | Imsi | 01-87 | 09-86 | — |

The all-time great vapor product would have to be Verbatim's (now Kodak's) optical drive announced in mid-1985 for delivery sometime in late '87. Runner-up: *Crosstolk Mork IV*, announced in April 1985, was heavily advertised in the following 2 months, but as of early November 1986, Microstuf hadn't shipped it.

### ForComment

(continued from page 54)

dow to leave comments or to alter text directly. Once a comment is written, it appears on-screen as a bullet in the left margin. After an editing session, the document is date- and time-stamped, making it easy to trace when it was reviewed.

Later, after all the copies of the annotated document have been returned to the author, *ForComment* collates them into a manageable whole. The original is never changed, and before a user changes the document using the Author disk, *ForComment* will automatically make a backup of the present version.

*ForComment* has a few built-in DOS utilities (DIR, COPY, and so forth), on-line help (F1), color-screen customizing, and EGA support (the option to use 43 lines of on-screen text or 25).

Documents created in any word processor that either saves files in or exports text into ASCII format are workable, though *ForComment* will read *WordStar*, *MultiMate*, and *WordPerfect* formats directly.

A $995 networked version of *ForComment* supports IBM's *PC Local Area Network Program*; Novell's *Advanced NetWare/86* and */286*; and 3Com's *Etherand 3Plus* series.

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System Requirements: IBM PC/XT/AT or 100% Compatible Computer. 256K RAM.

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CIRCLE 102 ON READER SERVICE CARD

■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

# SMALL-SYSTEM SNOBBERY

*Despite all the hype about connectivity, a wide gulf separates the PC manager from the mainframe manager. The main difference is mindset.*

I'm a snob. And maybe you are too. We've been beating up on the mainframe side of data processing ever since the first Apple II made its way onto some bright financial analyst's desk. We've razzed the mainframe guys about the 3-year backlog in the Systems Priorities Committee. We've waved our interactive applications generators and spreadsheets in their faces:

"Hey, Harry. C'mere and look at this. Pretty neat, huh? How come the overpriced hunk of junk in that big climate-controlled room can't do this?"

The answer is easy: it wasn't designed to. There's still a lot of life left in the old mainframe, and it's getting significantly better at interactive applications. But the average data processing manager gets less respect than Rodney Dangerfield, because users consider mainframe systems and languages to be low-tech.

I was forcibly reminded of this situation when I was reviewing the results of a recent survey we ran on *PC Magazine*'s Interactive Reader Service. In addition to downloading all the latest utility programs from our Productivity columns, we also give readers the option to answer surveys and express opinions. After all, an opinionated bunch like you needs an outlet.

This particular survey was about interaction with mainframes. We explored participants' experiences and attitudes toward offloading applications from mainframes to PCs and using the PC as a development tool for mainframe applications. As we expected, we found many people moving applications from mainframes to PCs. Systems analysts and infocenter staffers are rewriting applications in everything from *dBASE III* to compiled BASIC.

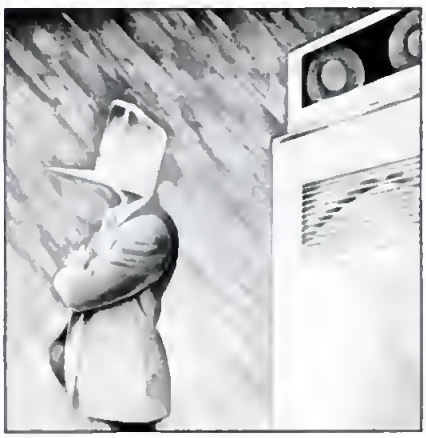
**COBOL BLUES** Most mainframe business applications are written in COBOL, so we were curious about PC users' attitudes toward it. After all, there are some excellent COBOL compilers available for the PC.

We might as well have not asked.

Altogether too many PC-responsible people are woefully ignorant of the products and their relative merits. They're so sure of the superiority of familiar PC programming environments that they won't even consider that there may be other correct answers.

Let's spend a moment and look at COBOL's merits and demerits:

COBOL is easy. COBOL's not much harder to learn to program in than, say, BASIC. The syntax is simple and straightforward. In fact, the original goal was for it to be as English-like as possible. You write COBOL in sentences and paragraphs with verbs and such. Each sentence even ends with a period.



Illustration, John Hale

COBOL is slow. That was certainly true once. In fact, some of those early COBOLs for the PC weren't worth the powder to blow 'em to hell. But today's compilers are as fast and sophisticated as you could want. I've even seen a screen-painting program written entirely in COBOL that gives you all the performance and features you could want in such a product.

COBOL is readable. One of COBOL's design goals was to produce code that the non–data processing professionals could read and understand its underlying logic. That's the case, but it takes longer to write it that way.

**WORDY** Which brings me to a related negative point. Most PC snobs say that COBOL is too wordy. Too wordy for whom? COBOL forces you to go the long way around for the sake of clarity. You say

```
MOVE ZEROES TO ACCOUNT_TOTAL
```

instead of something tricky like exclusive-oring a value with itself in order to make it zero. C programmers flip if they have to write

```
ADD 1 TO RECORD_COUNTER
```

once they've experienced the joy of C's increment operators. It doesn't matter. When it comes to maintaining code that someone else has written, give me COBOL every time. No, I don't suggest that

## ■ FROM THE EDITOR'S SCREEN

people should write word processors and database managers in COBOL, but it's still the language of choice where there's a big investment in code and it's going to have to be maintained over a long period of time by a changing cast of programmers.

There's another factor that you miss if you're too focused on single-user systems: the ease of multiple simultaneous access. The networking systems on PCs have only recently begun to solve problems that mainframers tackled 20 years ago. The de facto mainframe solution is the Customer Information and Control System, popularly known as CICS, sometimes pronounced "kicks." CICS is the connective tissue that gets all your terminals, whether remote or locally attached, together with your program. It handles a wealth of details that your program would otherwise have to be concerned with, saving countless lines of code and constant reinvention of the wheel.

COBOL is the best way into CICS. Define some screens in your program, give it some variable names, and you're in business, whether it's airline reservations or data to be entered by a handful of clerks.

**REVERSE SNOBBERY** For every PC chauvinist there is a mainframe snob who knows nothing and cares less about personal computers. Somehow these people manage to overlook what's going on around them, even though they're in the midst of a revolution. The biggest thing they're missing is increased productivity.

The PC has turned into a first-class programming tool for mainframe applications. The compilers are complete and compatible. They run faster on the PC than on a typically loaded mainframe. The editors and debuggers are better. One company, Realia, even offers a CICS emulator for the PC. Your program thinks it is running on a mainframe, communicating to 3270 terminals through CICS. By hooking two monitors to your system, you can even see the end user screen on one and run the debugger on the other.

Having such environments available is significant for more than just program development. We all know of sites where it just isn't feasible to run a 3270 line. But one or two users could benefit from occasional use of a program you already have running on the mainframe. No problem—just port it to a PC.

The sad thing is that few infocenter and data processing staffers are likely to change their positions. There's too much at stake politically. You know the old line about those who don't study history being condemned to repeat it?

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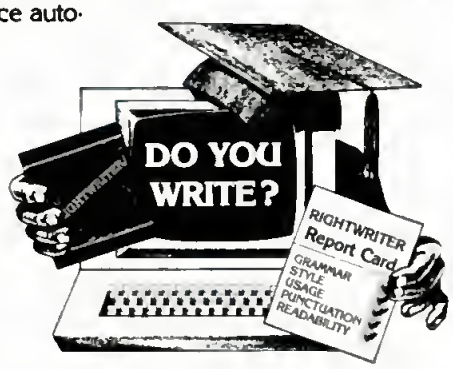


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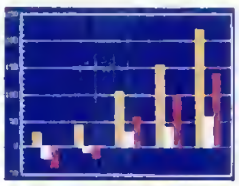

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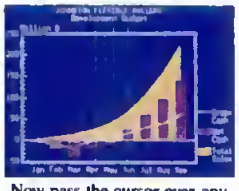

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# "A Superb EGA Card"

PC Magazine—Oct. 28, 1986

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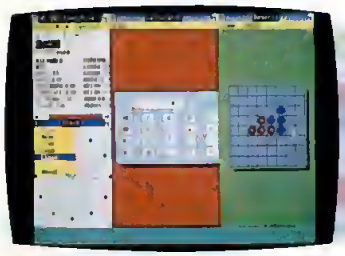
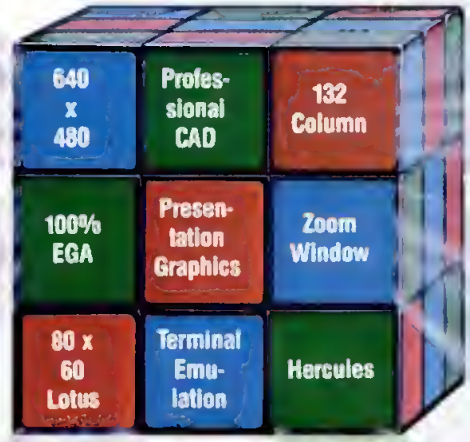
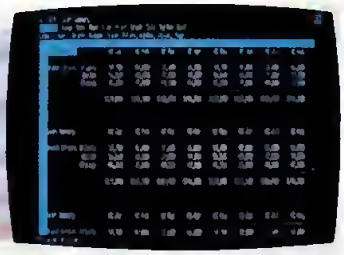


MS Windows/640 x 480



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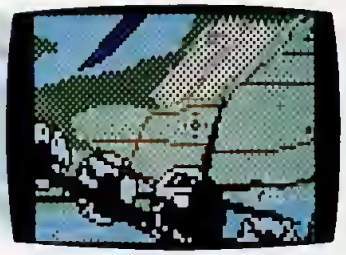

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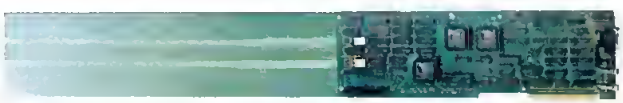

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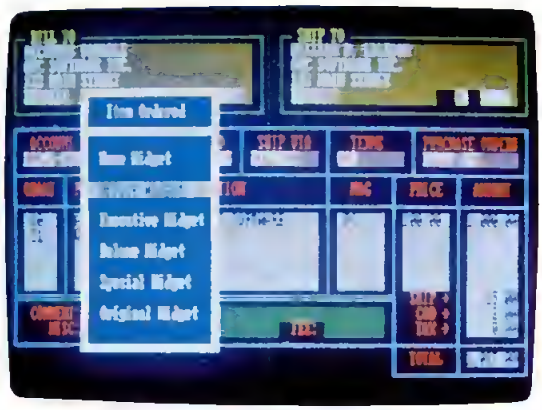

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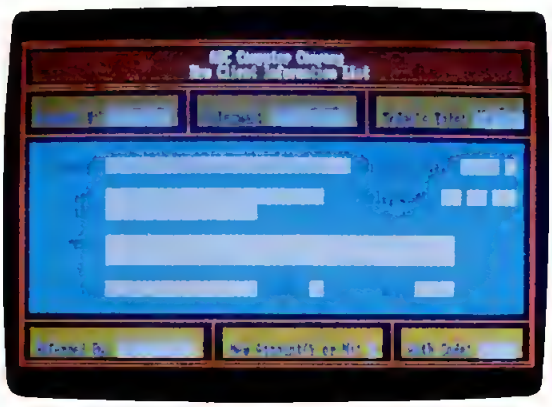

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■ JOHN C. DVORAK

# MAINFRAMES—HERE TO STAY

*Mainframes and micros can and do coexist happily. The long-standing myth that mainframe and micro people are in some sort of conflict or competition is damaging and plain wrong.*

There are two myths in the microcomputer business that we should get rid of once and for all. The first is the notion that microcomputers will doom the mainframe. The second is that the MIS guy in the large corporation is a complete fool and totally unaware of microcomputers.

These notions come from the early years of microcomputer adoption. The big boys laughed at the little computers, thinking that they were useless. Engineers knew better. They knew how to calculate instructions per second and cost-effectiveness.

But the little machines started to show up everywhere anyhow. A large contingent of microcomputer fanatics soon formed, most of whom knew nothing about the bigger machines. They just knew how many MIPS (.1–.2 in those days) a little machine could generate, as if that were all there was to computing. It's this group who thinks that the next micro will (when sold by the dozens) ruin any potential sale of the IBM 3090 or any other mainframe.

**ALIENATING EXPERTS** What this thinking does, unfortunately, is alienate the guy who knows better. Like the guy at GM who has to coordinate the activities of 10,000 terminals hooked to a network of monster machines supported by a football field full of high-speed disk drives. Tell *him* that the microcomputer will put him out of work.

We have to remember that the microcomputer is limited in throughput and that its architecture is designed with the idea that only one guy will use the thing.

Today's MIS pro knows this, but he is the target of another myth, the myth that an MIS director is a fool who doesn't know a microcomputer from a dumb terminal. This school of thought emphasizes teaching this "idiot" about the micro-to-mainframe connection. This school tells him things like "micros are here to stay." We start to see articles like "The Microcomputer—Its Place in the Office Is Secure!" and "Look Out, DP Man—Here Comes the Micro!"

**PAST THE PABULUM STAGE** Hey, folks, wake up! The house is on fire. These guys passed the pabulum stage years ago! The micro-to-mainframe connection has long since been made. MIS guys are now more like old-time hackers than most micro-oriented newcomers will ever be. The seminars about all this have come and gone, while at the same time a kind of "small-machine arrogance" has permeated the low end. This arrogance ignores the mainframers' professionalism.

■ MIS guys passed the pabulum stage years ago! They're more like old-time hackers than most micro-oriented newcomers will ever be.

This is not to say that just because someone comes from a mainframe background, he or she automatically has the ammunition to shoot it out with the microcomputer people. There are still a few souls isolated in mainframedom who are out to lunch when it comes to micros. At a recent *PC Magazine* Editors Day [*a traveling road show in which the editors of* PC Magazine *give vendors a chance to meet the press—Ed.*], my editor, Paul Stafford, and I saw a COBOL program generator that ran on a PC. A couple of mainframers wanted to sell it for $50,000 a copy (no kidding!). It seemed to work, but so what? They also developed a new user interface that they figured would be "hot" for the dopes in the micro world. They'd give this away for less than a hundred bucks. I got hold of a copy and it didn't take me 5 minutes to crash it. When it crashed, it junked up the screen, printed cryptic compiler error codes over and over, and then locked up the system. It was a laugh.

Five years ago, we'd have expected a mainframer to come up with something like this. Now it's unusual. Few microcomputer fanatics have come to grips with the new reality. In fact, there are now probably more naive micro nuts living in the ozone world than there are mainframers who can't understand the micro scene.

It's time to call a truce between these two groups and realize we are in this together. There is no battle.

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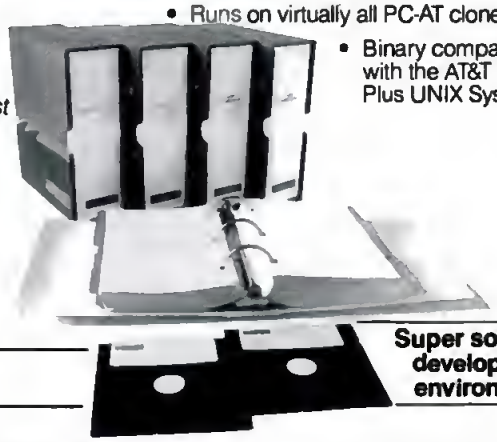

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# INSIDE TRACK

*Another new IBM keyboard? It can only mean that Big Blue's planning to close the box for good.*

**Not Again! Dept.:** Expect the IBM 386 machine to have a **redesigned keyboard.** As incredible as it sounds, it seems that IBM will again change the keyboard on its line of PCs. So far we've seen the PC keyboard, the Chiclet keyboard, the 3270 keyboard, the Convertible keyboard, the enhanced keyboard, and the AT keyboard, not to mention the various keyboards found on different terminals and typewriters. When will it stop?

Apparently IBM has established a new in-house group whose focus is **keyboard standardization.** "The new keyboard is a bit more like a Selectric keyboard," I'm told. Apparently there will also be **four new keys**. These are assumed to be some sort of **mega-macro keys** that communicate with the operating system for some **bizarre functions**. Looks like IBM will finally start to do what old-timers have always said: lock things up and pull out the rug.

**An Idea Whose Time Is Now! Dept.:** I saw an ad the other day for a **UNIX shell** that ran under MS-DOS. Pretty silly idea. It wasn't UNIX, of course; it was just some UNIX hacker's dream of changing the DOS commands to be like UNIX. **A better idea** is to put an MS-DOS shell on a UNIX system.

**Here's a much better idea**. First some background. CONVEX is a company that makes a UNIX-based supermini. Because of their parallel architecture, these types of machines are called "Crayettes." CONVEX wants to **penetrate** the DEC VAX business. The DEC world is dominated by an operating system called VMS. To get people over to UNIX CONVEX, put a **VMS shell** over its UNIX. You can issue either UNIX or VMS commands to the computer. The **beauty** of the system is that when you issue a VMS command, the shell tells you what the equivalent command in UNIX would be. So you can slowly learn UNIX **without the hassle**. Smart move.

**The Big Product of 1987 Dept.:** Look for the **TOPS network** to be one of the hot low-cost LANs next year. Designed around the AppleTalk low-speed network, it's the only network I've seen that **hooks Macintoshes to PCs**. Any machine can be a file server for any other machine. It's an inexpensive solution to a network dilemma in a small office. Specs: Baseband, CSMA/CA, .23 or .8 megabits per second, 32 users per bus, twisted-pair wiring, will gateway to other nets. Cost: $149 per Mac, $389 per PC. Contact **Centram Systems West**, 2372 Ellsworth Ave., Berkeley, CA 94704; (415) 644-8244.

By the way, did you know that the **number-one LAN in the world is AppleTalk?** Look it up—there are more AppleTalk connections than any other network. Of course, it's a trick question because when the Apple LaserWriter is hooked to even one computer, it's always through an AppleTalk connection. A good fact to win a bet with.

**Hotter Than Hot Dept.:** This should be the **product of the year**. It's called **PhoneNET**. It's a $49 connection that allows you to hook your twisted-pair LAN (AppleTalk using a mini-DIN8 connector or TOPS) into the phone system. This converter was invented by some **botshot** students at Cal Berkeley. They figured that the old phone wiring now has two unused wires—the black and yellow wires. Most phones use only the green and red wires. This means you can run your network over the **old prewired phone system** in your office or home through the same RJ11 jack you use for the phone. With a duplex plug you can have your computer and your phone plugged into the same jack. It was originally designed so the kids could network their Macintoshes throughout a frat house via AppleTalk or TOPS without having to buy any wire.

If you don't have RJ11 jacks all over the place, the PhoneNET adapter also lets you wire the computers together with the **cheap telco wires** available at Radio Shack. **A great product**. Perfect for the small office or the home with two or three computers scattered about. Available from **Farallon Computing**, 1442A Walnut St., #64, Berkeley, CA 94709; (415) 849-2331.

**While on the Subject of Interfacing Dissimilar Machines Dept.:** I came across a product that saves the poor owner of the DEC Rainbow **the embarrassment of incompatibility**. It's called Code Blue. The MS-DOS on the Rainbow is so incompatible with PC-DOS on the IBM that many programs won't work. If you have a loaded Rainbow with more than 768K bytes of memory, it will even capture memory-mapped graphics that bypass the DOS.

At $99, it's **cheaper** than buying a new computer. Contact Intersecting Concepts, 4573 Heatherglen Ct., Moorpark, CA 93021; (805) 529-5073.

**Legal Eagle Dept.:** Have you noticed one too many lawsuits in the microcomputer business? While none of this may be avoidable as people **substitute litigation for creativity**, the least you can do is take a peek at the *High Technology Law Journal*. It's pretty slick. Published by the University of Califomia Press, it's edited by some talented Boalt Hall law students. Subscriptions are $80 for four issues (2 years' worth). Available from the Subscription Manager, University of California Press, Berkeley, CA 94720. It's a must for any lawyer dabbling with technology and the law. PC

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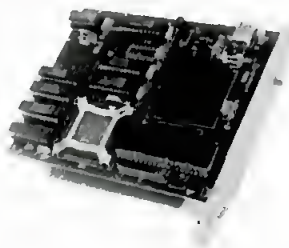

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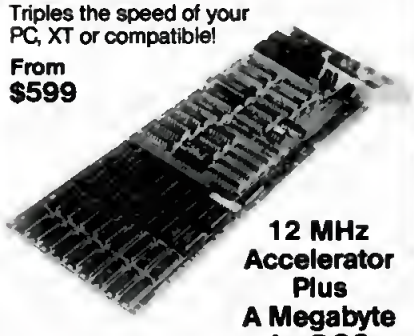

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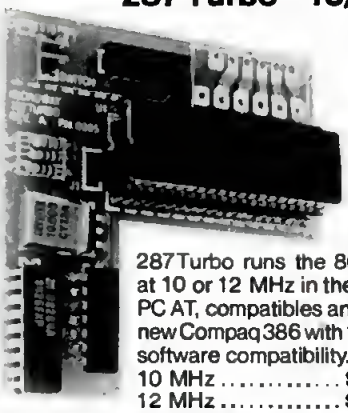

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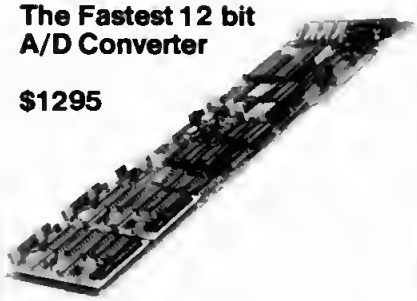

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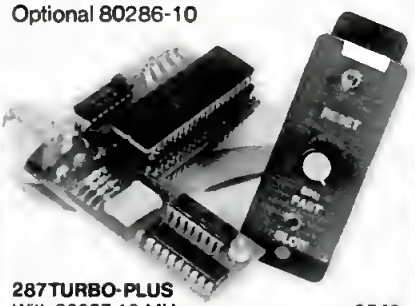

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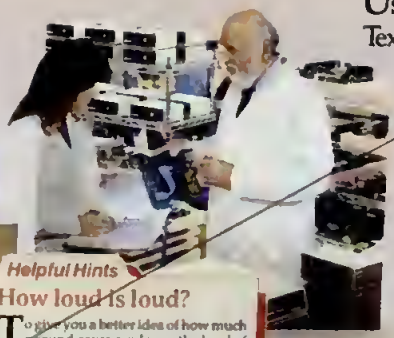

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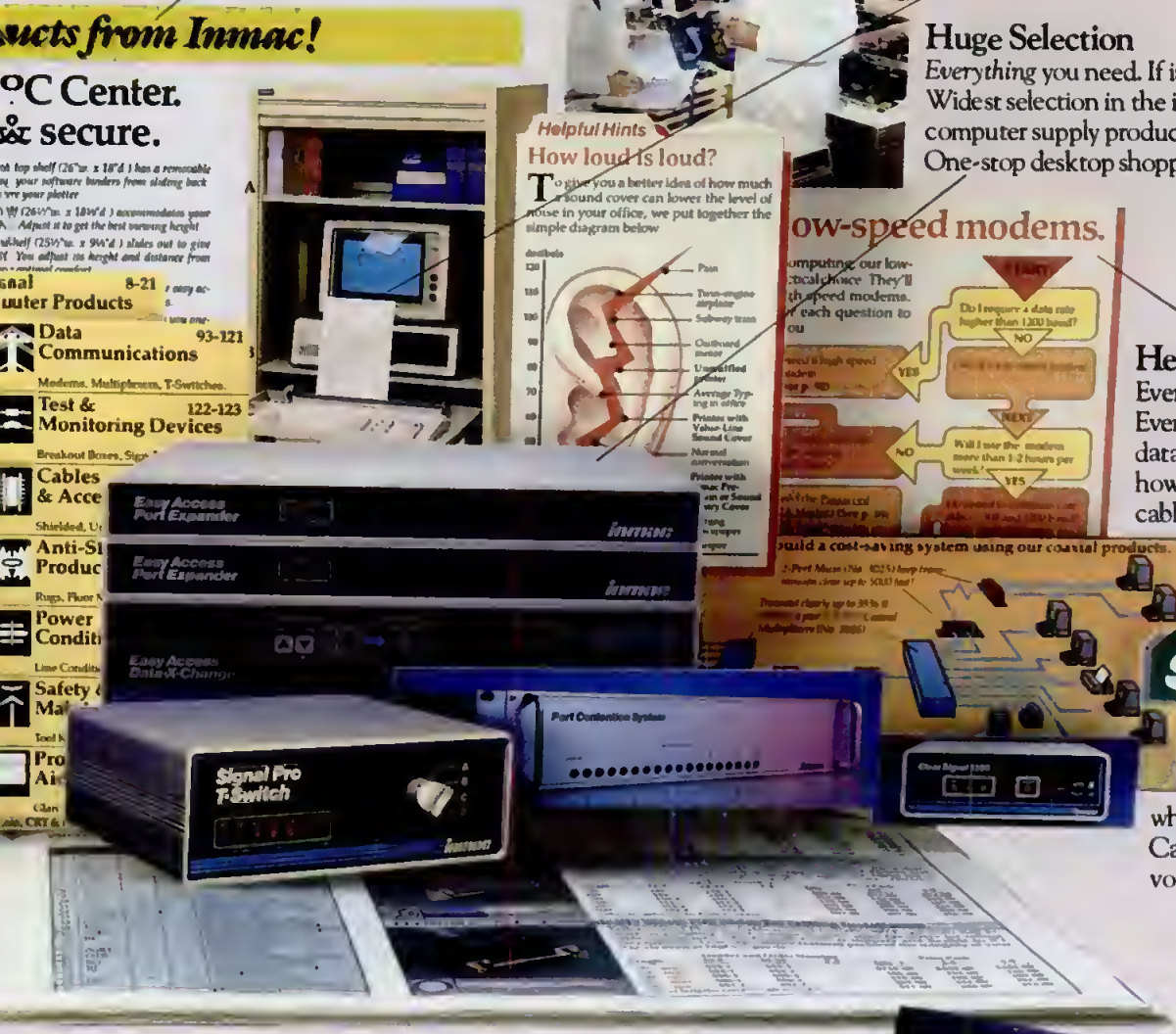


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■ PETER NORTON

# THE SOFTWARE REVOLUTION, PART 1

*Developments like the dominance of C, the introduction of HAL, and improvements in editor/compiler interaction make life better and easier for users and programmers alike.*

The big action—or at least the big noise—in software has been in applications, particularly business productivity tools like *1-2-3* and *HAL*, *1-2-3*'s new, very impressive intelligent front end (more on *HAL* shortly). Meanwhile, the wellspring of all these hot programs, namely the hardworking programmer, has been neglected. Or so it seems.

As far as most of us are aware, most of the software action by programmers has been concentrated on producing more-efficient compilers (witness the heavy competition among compiler makers to come up with the most tightly optimized C code) and on producing subroutine libraries (such as Blaise Computing's Pascal and C tools and seemingly endless others). It used to be that all the programmers in the country were writing their own editors; now it seems that they're all writing their own C libraries. That's a sin even I'm guilty of; when I converted my programs from Pascal to C (once again, more on that later), I didn't use a single off-the-shelf library routine; instead, I wrote my own.

**PROGRAMMING REVOLUTION** Anyway, it has seemed as if this has been just about all the action going on in the programmer's arena, but that's not the case. In fact, there has been a major revolution developing in programmer's tools. If you do any programming, what's been going on should be very important to you. Even if you're just sitting on the sidelines of the programming game, the new developments in programming tools will affect you because they should have a significant impact on the quality and number of programs created for the PC.

This revolution in software tools is typified by two classes of tools—program-development environments, such as Turbo Pascal and QuickBASIC, and testing and debugging environments, such as *SymDeb* and *CodeView*. In Parts 2 and 3 of this series, I'll discuss the power of programming and debugging environments in more detail. Now, though, what we need to discuss are some of the issues that lie behind the changes that are going on in the programming world.

One remarkable development has been the extremely rapid acceptance of C as the professional's PC programming language choice. It was only a couple of years ago that there was a wide choice of languages. Assembler, Pascal, and, as an up-and-comer, C were all widely considered good choices for serious PC programming. Now, that's very much changed. Many languages are still heavily used; only C is acclaimed as the professional's choice.

Illustration: John Hale

As best I can tell, C has become dominant for three reasons. One is programmer's snobbery: Unlike Pascal, C is a "dirty" language that encourages programming tricks and that has few built-in safety features. So C satisfies the hacker who is lurking beneath the surface of even the most well-behaved programmer.

The other reasons are the wide selection of high-quality C compilers and the fact that C programs tend to be tight. Example: When I was planning to switch my *Utilities* from Pascal to C, as a test I converted the simplest of them—the TimeMark program—and discovered to my amazement that even though I had added lots of features to the program, the C version was half the size of the Pascal version.

Although Pascal has had some strong advantages—particularly that it's heavily taught in schools and that Borland's Turbo Pascal compiler has vast popularity—there haven't been enough to overcome the big drift out to C.

**C OVER PASCAL** The popularity of C, by the way, has definitely been a drift away from Pascal in particular. In a survey that Microsoft took of its C compiler customers, the company found that most new C programmers were using Pascal before switching to C.

It appears that programmers learn what I consider to be true professional programming—that is, good structured programming—in Pascal, and then with the discipline of Pascal under their belts, they

■ **PETER NORTON**

switch to C for more powerful and efficient programming.

There are probably two reasons why those C programmers already know Pascal. One is that Pascal is being strongly emphasized in schools, which is reasonable enough, since Pascal was originally created as a language simply to teach programming with, rather than as a language to do real-world programming in. The other reason is Borland's Turbo Pascal, a compiler that made Pascal both very affordable and easy to use, thanks to Turbo's interactive program-compile-and-test environment.

Since it now appears that C is the language that PC programmers are hot for, it would be interesting to know why we haven't seen a "Turbo C," meaning a hot, interactive programming environment for C. Borland knows how to do it, of course, since it invented the genre with Turbo Pascal. Microsoft also knows how to do it, as it has proven with QuickBASIC (which I'll discuss in Part 2). Although Microsoft, like IBM, doesn't talk about unannounced products that it has under development, the company is quite candid about having other "Quick" languages in the works and makes it clear that C is its first priority.

Apparently Microsoft considers itself to be in a tough race to see if a Microsoft QuickC can beat a Borland Turbo C. It seems to figure that Borland's Philippe Kahn is wasting his time with the likes of Turbo PROLOG instead of concentrating his efforts where the real action is.

One thing is very clear: we're rapidly heading for a world in which our PC programs work much more with us and for us, rather than simply carrying out their chores in a blind way. Aside from how this big change is affecting programmers, changes are also affecting them in other realms—witness *HAL*, Lotus's smart front end for *1-2-3*.

*HAL*, as you've probably been reading, does remarkable things to make *1-2-3* easier to use and adds some very important power to the program as well—such as extracting a meaningful summary of all the formulas in a table so that they can be checked for problems.

Of course, since *1-2-3* isn't just a static application but a programmable one, you could argue that the changes *HAL* brings to *1-2-3* fit directly into my topic of improved programming environments, since *1-2-3* is, after all, the most-used *user* programming language (as opposed to *programmer* programming language).

**BACK TO THE FUTURE** The integration of *HAL* and *1-2-3* brings up a very tricky issue regarding computing's progress toward these smarter and more inter-

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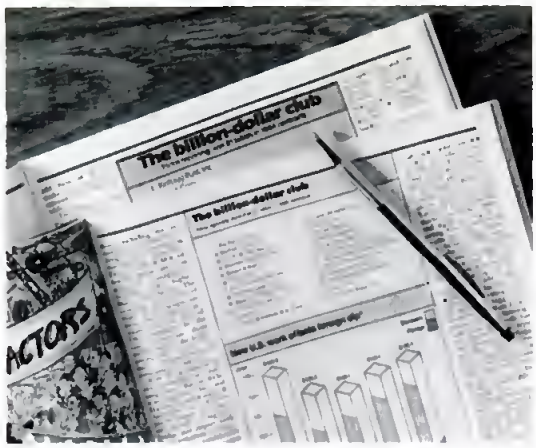


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■ **PETER NORTON**

active environments—the problem of leaving the past behind.

In the case of QuickBASIC and *CodeView*, there is relatively little conflict between the goals of the new environment and the old traditions that the program has to work with (and in both of those cases, there were some important steps toward breaking out of the worst disadvantages of the old way of doing things). But in the case of *HAL/1-2-3*, Lotus is committed to working within the extremely backward user interface that *1-2-3* was born with.

In one sense this whole issue of smarter, better, more interactive, and more all-encompassing (that is, "environmental") programs is part of the broadening issue of better user interfaces for programs. We've seen in the past the decline of once-popular programs that were surpassed by others that were more attractive to use (that is, with better user interfaces). *1-2-3* itself was one of these, surpassing the more primitive *VisiCalc*. For all the power of *1-2-3*, though, its user interface went little beyond *VisiCalc*'s, and now we see much better interfaces—particularly in *Framework* and in the soon-to-appear-on-PC-screens *Excel*.

■ Since it appears that C is the language that PC programmers are hot for, it would be interesting to know why we haven't seen a "Turbo C."

As smart, sophisticated, and wonderful as *HAL* is, it is still burdened with the very backward *1-2-3* user interface that holds it back from any major progress.

But even if I'm right in thinking that *HAL* points up how backward *1-2-3* is at the same time that it moves *1-2-3* forward, that's just a minor ripple in the major new wave that's leading software and software development in a very important new direction. PC

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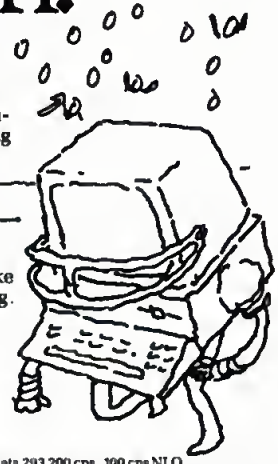

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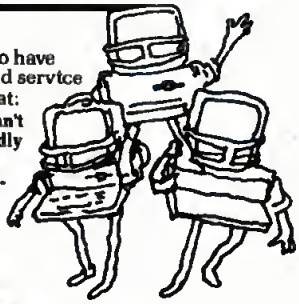

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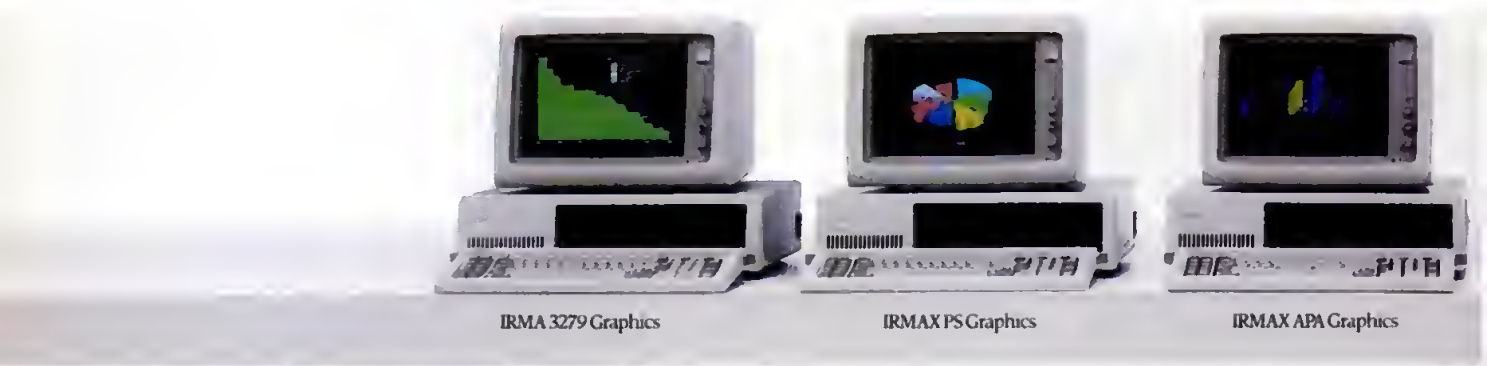

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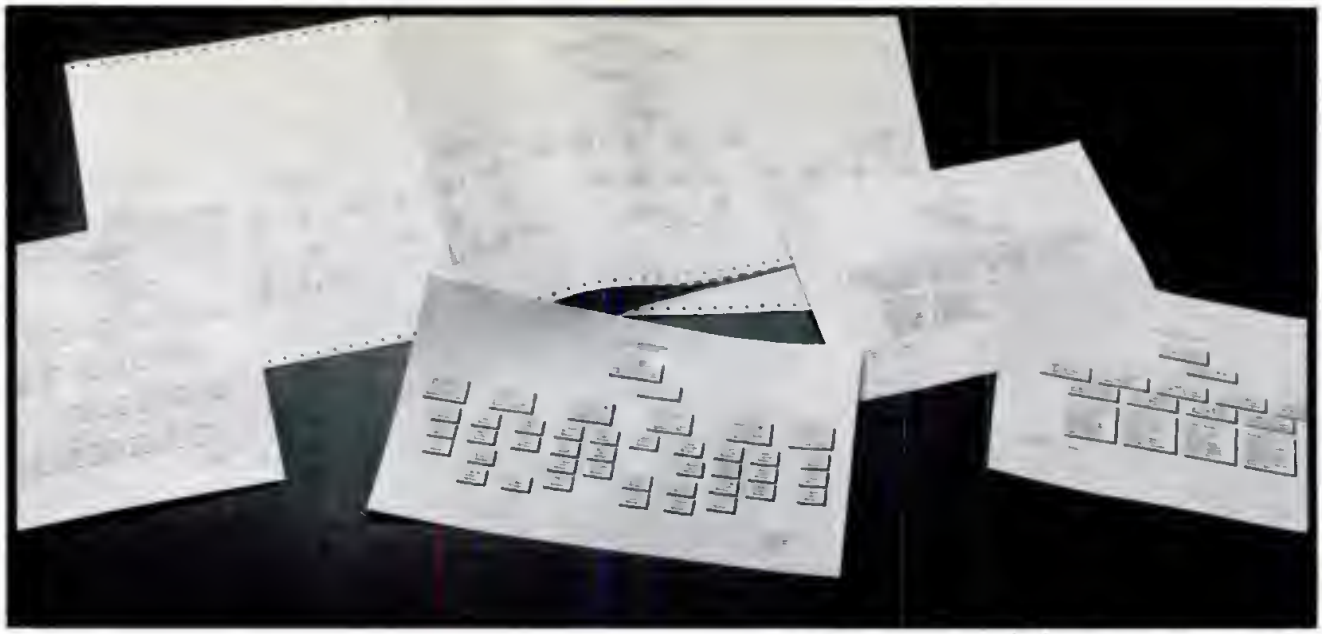

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■ JIM SEYMOUR

# DESKTOP PUBLISHING: MYTHS AND REALITIES

*You keep hearing about the enormous potential of desktop publishing, with typeset-quality documents pouring from zillions of workstations all over the land. Wishful thinking, maybe?*

Can we talk? An awful lot of my time is spent these days dealing with desktop publishing issues. It's a hot topic in question-and-answer sessions after speeches, in sessions with clients, in reader mail, in these pages. And we've been using desktop publishing systems in my office for a little over 2 years, so there's a good deal of daily hands-on wrestling with the hardware and software, as well as the concepts, behind the desktop publishing (DP) boom.

All of which is making me cranky about the desktop publishing hooey that's getting passed off these days.

The hype's gotten out of hand, not only in terms of overpromising but also in simply ignoring some realities. A few of those realities:

■ **Can we find a better name?** PC-based DP isn't publishing, it's just page makeup. As better DP tools let us combine more elements in more ways into more pages per document, we're creeping up on something like a real publishing system. But if we could just recognize today's PC DP for what it is—replacing razor blades, waxers, and pastepots with electronic page-assembly—there'd be a lot less noise in what has become an almost unbelievably confused market.

■ **PC DP is an application, not a dedicated function.** That idea has appeared often in these pages, if in slightly different words. Unfortunately, while almost everyone in the desktop publishing software and hardware business acknowledges that truth in private, in public they still talk as if there will be huge fleets of de facto dedicated DP PCs. That's encouraged by the loopy forecasts I see from some PC market-research shops, which posit the installation of zillions of more-or-less dedicated DP workstations over the next couple of years.

Of course, a lot of PCs will be used by graphic artists and production people almost exclusively as DP workstations. But the larger part by far of the DP market will be folks who use DP occasionally, as one of several applications on their PCs.

■ **There's a world beyond newsletters.** Why do DP software publishers act as if newsletters are the highest and best (and almost the only) use of DP tools? Our society is chock-full of newsletters—newslittered—and putting out some of those with DP systems will make them tidier. But there's a huge, rich market for producing price lists, catalog sheets, programs, handouts, flyers, labels, and a thousand more printed pieces on DP systems. Less sexy, maybe, but important and far larger than the newsletter market.

■ **This isn't a one-product market.** It seems likely that the first big winner in PC desktop publishing software will come from a short list: Aldus's *PageMaker*, Xerox's *Ventura*, and Software Publishing's *Harvard* packages, with MicroPro's Island Graphics product a very dark horse.

But the varying requirements of the different corners of the DP market mean there are fine opportunities for several kinds of DP software. *PageMaker*'s interactive approach is great for shorter jobs, for example, but for books and other long documents, you'll want the batch-job approach of a *Ventura*.

And Indigo's *iPrint* is a fine tool for producing office forms. That's a big and important market, and one well suited to desktop publishing. But if we keep holding DP software up to the "How does it handle newsletters?" test, good products like *iPrint* are going to get overlooked.

■ **Not everything's better with DP.** Until about a year ago, Apple produced a useful, extremely well-designed newsletter called *Professional Solutions*. With the importance of the DP market to Apple, the company redid the publication to make it possible to produce on a Mac and LaserWriter. Now it looks cheap and shoddy—not just worse than before, but a dramatic refutation of the implicit argument Apple was trying to make.

Which leads directly to:

■ **Whatever happened to design?** Do you remember those first heady days of the Mac, 3 years ago, when people started sending their friends letters that looked like ran-

Illustration: John Hale

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■ JIM SEYMOUR

som notes pasted up from the morning paper's headlines by half-crazed kidnappers? DP's bringing all that back for a rerun.

There's more to turning out effective printed pieces than mastering a PC desktop publishing software package. Good design counts, too.

One of the ironies here is that some people have already begun to accept the mistaken notion that desktop publishing automatically means poorer design—or simply no design. Look at the publications of Aldus Corp., the people behind *PageMaker*. These publications are put together with the same DP tools most of us use, but they're beautiful, award winners in anyone's design competition.

■ **We need better reproduction.** The day of 300 by 300 dots per inch looking good is over. It's nice that the page description language of choice, PostScript, supports higher-res Linotronic typesetting equipment, but the bulk of DP output is going to come from desktop laser printers. The first $5,000 600- by 600-dot-per-inch desktop lasers to come on the scene are quickly going to change people's minds about the acceptability of 300 by 300.

And we need better renditions of popular typefaces. You can always spot Helvetica from a LaserWriter when it's been reproduced from a paper original: the strokes of the letters look pinched in the middle and bulgy at the ends. That's just not good enough, folks.

Fast 286 and 386 designs make PCs the right inflection point in the desktop publishing market between the Mac's limitations and the cost of big-time Xerox and Interleaf systems. With relatively commonplace peripherals—EGA-style monitors and video boards, laser printers—PC DP is very effective. With specialized peripherals, such as Moniterm's sensational Viking display, PCs can be highly optimized for DP.

It's time for us to start living up to the potential of the tool. We could do worse than by starting to tell the truth about PC desktop publishing. PC

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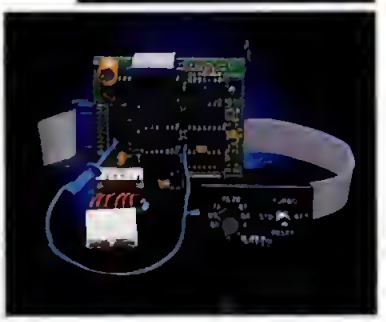

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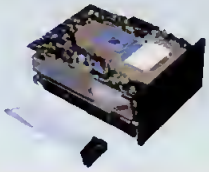

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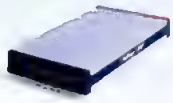

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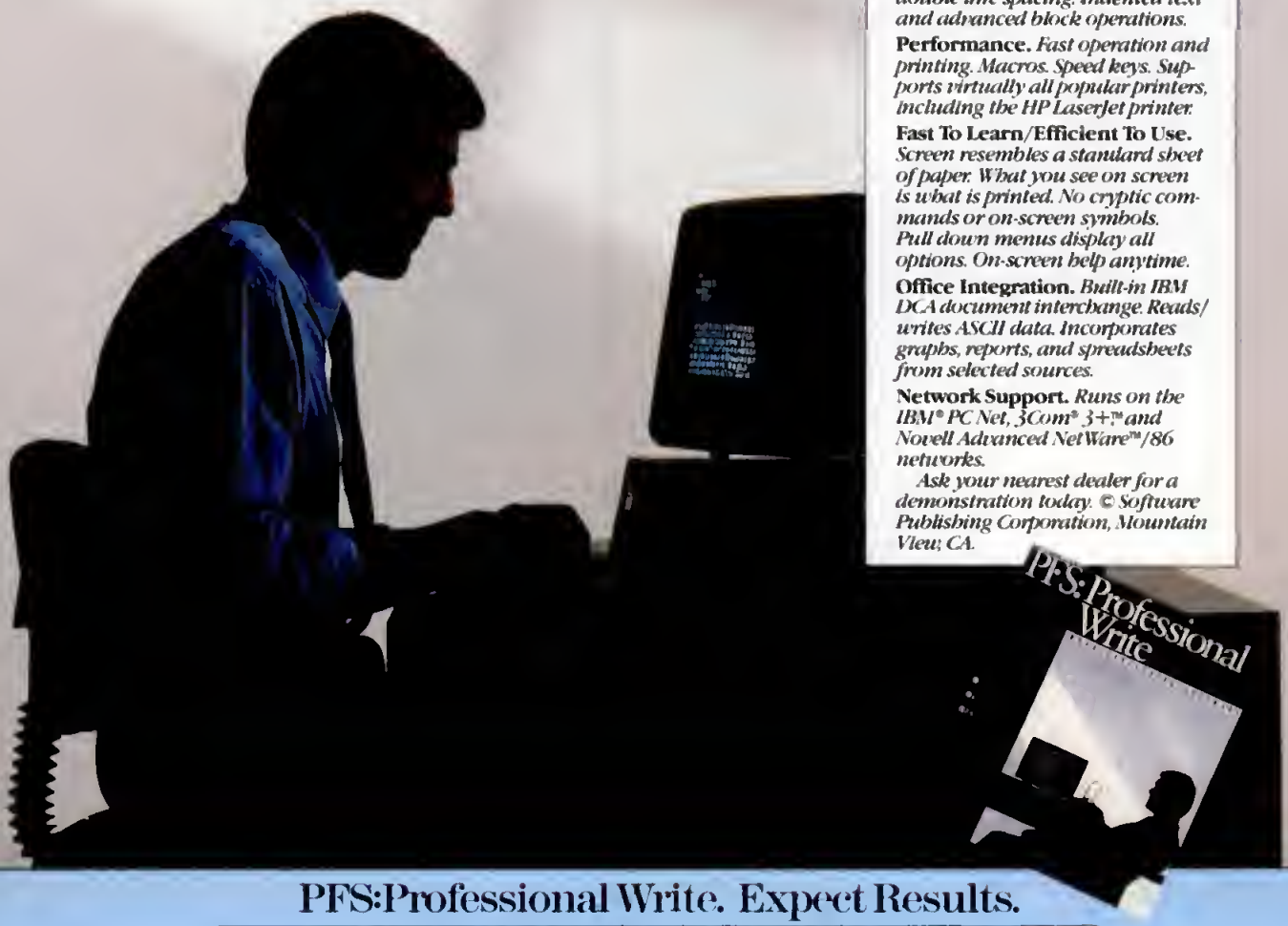


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■ STEPHEN MANES

# WHATEVER HAPPENED TO ERGONOMICS?

*Ergonomics used to be a hot topic. Now, user comfort has become a dead issue—much to the dismay of many near-dead (or at least very uncomfortable) users.*

Everybody talks about the idea of comfort for the oppressed portion of humanity that uses computers. As my neck, fingers, back, and eyes will attest, hardly anybody does a damned thing about it.

The early days of the PC saw a lot of welcome fanfare about ergonomics. This very magazine made it a feature topic in one issue. But *ergonomic* quickly became a buzzword, like *user friendly* before it. It has since been banished to office equipment catalogs, where its application to a piece of furniture jacks the price up a hundred smackers.

In today's quick-buck, lowball atmosphere, cost-cutters masquerade as product "improvements." Take the cheap new keyboard for the IBM line (please!): The elegant feel of the original is a fuzzy concept, hard to dramatize in an advertisement. So it's gone, and instead IBM sells the obvious new layout as a wonderful improvement.

Meanwhile, nobody seems to address keyboard users who develop hand pain. One tech writer friend has been warned by his doctor to severely curtail his sessions at the keyboard; lately I've had strange aches in my fingers. Now, it may well be that our pinkies are just doing more work than human digits were designed for. But a more elegant solution than simply slowing down would be welcome.

**SORE POINT** Office chairs are another literal sore point. When my ancient spring-upholstered model began to develop holes in the seat, I spent more than a year scouting out a satisfactory replacement. There are posture chairs, lumbar chairs, hydraulic chairs, saddle-seat chairs, digital chairs—for all I know, even electric chairs with a vibrating massage. But there's no chair for me.

What I wanted was a simple adjustable chair with padded arms that would support mine while I was typing—in other words, a chair much like the one I already had. No go. These days chair arms tend to be made of hard plastic, and even when padded they're a couple of inches too low to be of any use whatever to anyone taller than, say, 5 feet 8 inches.

The excuses for this are graven in stone in the Furniture Salesman's Bible. Some "experts" say it's not good to rest your arms on anything while typing. Apparently they haven't typed much. Some point out that a chair with high arms won't roll under a desk. I can't imagine how my old chair managed the trick. And some claim high, functional arms don't look nice in an office setting. Who, I wonder, would notice?

A computer dealer friend finally found The Chair of My Dreams. From Denmark, it had separate hydraulic adjustments for seat height, tilt, back height, and back angle—and, miracle of miracles, padded, adjustable arms. The pictures in the brochure showed happily seated Danes engrossed in their work.

I will spare you the long history of my attempts to buy this thing, including the 2-month delay before receiving a test-sit on the icy sidewalk outside my apartment building in the dead of winter. Suffice it to say I bought it. It does everything it's supposed to, except one of the adjustable arms tends to jam in the up position. Which wouldn't be so bad if the chair weren't uncomfortable as hell.

Even all the way up, its arms are a tad too low to give mine any support at all while I type. The adjustable back is neither high enough nor low enough. The seat cushion has all the suppleness of a park bench. And my legs, back, and neck, cognizant of all this, reward me with exquisite aches. The joke is that the thing was supposedly designed by an ergonomist. He probably works standing up.

Is it hard to imagine a seat in which you can while away hours without significant fatigue even though your arms are extended in a rather awkward position? Of course not; check your car for details. And then wonder why some enterprising customizer hasn't bought a few spare buckets, stuck 'em on pedestals, and added arms.

Illustration: John Hale

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| Map Master | Call |
| Microsoft Buss Mouse | 106 |
| Microsoft Chart | 164 |
| Microsoft Serial Mouse | 119 |
| News Room | 31 |
| PC Buss Plus Mouse with Paint Plus | 115 |
| PC Draw | 199 |
| PC Mouse w/Dr. Halo II | 99 |
| PC Mouse w/Paint Plus | 115 |
| PFS Graph | 76 |
| Printmaster | 29 |
| Print Shop | 32 |
| Signmaster | Call |
| Turbo Graphix Tool Box | 38 |
| Windows Draw!! | 102 |

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| CYMA | Call |
| DAC Easy Accounting | 38 |
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| Masterpiece | 84 |
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| Lotus Report Writer | 99 |
| Multiplan | 108 |
| PFS Plan | 76 |
| Spreadsheet Auditor 3.0 | 82 |
| Supercalc 4 | Call |
| Twin | 47 |
| VP Planner | 47 |

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| Revelation Bump Disk | 249 |
| R Base 5000 System V | 355 |
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| Think Tank | 91 |
| VP Info | 47 |

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|---|---|
| Harvard Total Project Manager | $262 |
| Microsoft Project | 219 |
| Super Project Plus | Call |
| Timeline 2.0 | 205 |

### INTEGRATIVE SOFTWARE

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|---|---|
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| Enable 1.1 | 319 |
| Framework II | Call |
| Open Access II | 285 |
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| Smart Software System Lan Pack | 799 |
| Symphony | Call |

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|---|---|
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| Leading Edge Word Processor | 42 |
| Leading Edge W/P with Spell & Merg | 72 |
| Lightening | 55 |
| Microsoft Word 3.1 | 249 |
| Multimate 3.3 | 209 |
| Multimate Advantage | Call |

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| C Compiler (Microsoft) | 249 |
| Cobol Compiler (Microsoft) | 386 |
| Fortran Compiler (Microsoft) | 195 |
| Lattice C Compiler | 242 |
| Macro Assembler (Microsoft) | 84 |
| Run C Interpreter | 65 |
| Ryan McFarlan Fortran | 305 |
| Ryan McFarlan Cobol | 479 |
| Pascal Compiler (Microsoft) | 166 |
| Quick Basic 2 | 55 |
| Turbo Jumbo Pack (New Ver.) | 159 |
| Turbo Pascal w/8087 & BCD | 55 |
| Turbo Prolog | 54 |
| Turbo DataBase Tool Box | 38 |

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| MS Learning DOS | 28 |
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| Turbo Tutor II | 23 |
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| PFS Access | 76 |
| Remote | 92 |
| Smartcom II | 82 |
| PFS Professional Write | Call |
| Ready | 49 |
| Smart Spell Checker | 68 |
| Volkswriter 3 | 136 |
| Volkswriter Deluxe Plus | 59 |
| Volkswriter Scientific | 235 |
| Webster New World Writer | 73 |
| Webster Spell Checker | 33 |
| Webster Thesaurus | 39 |
| Word Perfect Library | 56 |
| Word Perfect (Ver 4.1) | 199 |
| Wordstar w/Tutor 3.31 | 162 |
| Wordstar Pro Pack 3.31 | 233 |
| Wordstar 2000 2.0 | 233 |
| Wordstar 2000 Plus 2.0 | 278 |
| Word Wizard | 38 |

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| Copy II PC | 19 |
| Copywrite | 39 |
| Cubit | 25 |
| Disk Optimizer | 25 |
| Double DOS | 25 |
| DR DOS | 27 |
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| Homebase 2.0 | 37 |
| Gem Collection | 109 |
| Gem Desktop | 27 |
| Keyworks | 49 |
| Microsoft Windows | 55 |
| Norton Commander | 36 |
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| 635 | 1019 |
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| 8810, 08850 | 1049 |
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| P-6 | 439 |
| P-7 | 619 |
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| 1091 I | 265 |
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| 1592 | 409 |
| KXP3151 | 385 |
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| 341 | 689 |
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| QVT Amber 101 | 315 |
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| 50 | 379 |
| 75 | 565 |
| 85 | 469 |
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| 10 Meg | $1195 |
| 20 Meg | 1595 |
| 40 Meg | 2325 |
| **Segate 20 MG w/WD Controller** | 385 |

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| Advantage | $ 329 |
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| Six Pack Plus | 135 |
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| Color Card | 149 |
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| Tiny Turbo | 415 |
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| 5 Pack | 99 |
| **Plus Development** | |
| Plus Hard Card 20 Megabyte | 659 |
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| **Quadran** | |
| Gold/Silver Boards | 139 |
| **Tecmar** | |
| Graphics Master | 439 |
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| Business Partner | $ 979 |
| Sr. Partner | 1169 |
| Exec. Partner Dual Drive | 2479 |
| **Toshiba** | |
| T-1100 | 1309 |
| T-1100 Plus | 1629 |
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| **Zenith** | Call |
| **Wyse** | |
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CIRCLE 206 ON READER SERVICE CARD

■ STEPHEN MANES

**FAST FLICKER** Set aside puzzling concerns about radiation and consider the screen itself. Displays driven by plain-vanilla IBM Color Graphics Adapters tend to flash on and off every time they scroll the screen. Headaches tend to follow. Here, at least, a variety of solutions have been developed.

But there's no solution for a more insidious form of screen flicker that nobody talks about—the inherent flicker from the paint-and-decay cycle every monitor uses 60 times a second or so. The IBM monochrome display is one of the few that get around the problem—by using high-persistence phosphors that don't decay fast enough to flicker. But that creates another annoyance—little "vapor trails" on the screen, which some users find unacceptable.

**OUT OF PHASE** Inherent flicker is particularly noticeable with color screens and graphics-oriented black-on-white displays like the Macintosh's. Those of us sensitive to this effect—compounded by fluorescent lighting, which tends to flicker at the same rate but slightly out of phase—can quickly get downright nauseated from it. Yet the purveyors of graphics-oriented schemes like Mac and *Windows* don't seem to worry a bit about us users who find this inherent flicker intolerable. For us, it's move up and throw up.

Is noise good for you? Your machine probably has a nice loud fan and a hard disk that sounds like three felines caterwauling as they waltz across garbage cans. Some people can actually hear the high-pitched wail of many monitors' flyback transformers. At least printers are getting quieter.

**DESENSITIZED CITIZENS** But who cares? Hardly anybody. In a country whose citizens are desensitized enough to watch hours of network television per capita per day, these good folks probably assume that their headaches and backaches and eyestrain just go with the job. So they rub their eyes, pop a couple of aspirin, and go about their business, never realizing that things could be better.

Things probably won't get much better until someone figures out how to sell sensitive design, and the outlook is not rosy. The only company that I can recall pushing the ergonomics of its microcomputers was Ericsson. Granted, Ericsson's concern for its users' comfort was more bark than bite—its machines didn't seem particularly unusual and had their own particular failings. Still, it's probably significant that the Swedish manufacturer is no longer in the microcomputer business in the good old U. S. of A.


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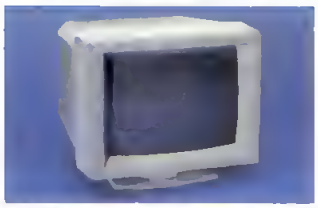

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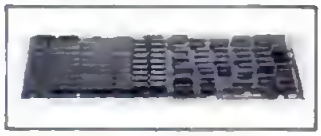

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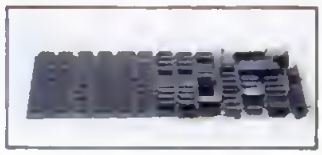

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Free end
Slip-sheet
Front side
Fold
Folded edge of the page
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1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet
Free end
Slip-sheet
Front side
Fold

1. Follow instructions on the other side

Inverted Back

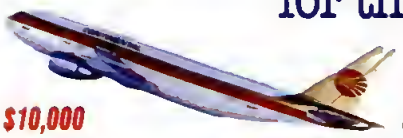
GbsSlipBack-0018

Back

1. Follow instructions on the other side

## Borland's Instant Winner Game

# Scratch this card now and you could *instantly win* 2 free round-trip airline tickets to Australia for the America's Cup Race!



$10,000

First Prize ($10,000 value!) includes accommodations for two in Perth, Australia during the final America's Cup races, which start January 31, 1987. See America win it back after our *only* loss in 134 years! There's more than one *instant winner* in Borland's Instant Winner Game, because you could win one of two new $6,895 4-WD Suzuki Samurai convertibles,

$6,895

or a $4,995 AST TurboLaser™ printer, or a $4,499 Toshiba T3100,™ or a $2,399 Toshiba T1100™ Plus, or a $595 AST SixPakPremium™, or a $69.95 Traveling SideKick,® or any one of hundreds of other Borland products—and at the very least a Borland Rebate Coupon, good for $10 off any single product or $15 off any bundled product offer!

$4,499

$69.95

See Official Rules on the back of this card for details.

Don't delay! There will be a second-chance drawing for the trip if not claimed by 12/30/86. There's also a second-chance drawing for the two Suzukis if not claimed by 2/26/87. All rebate coupons are good for products purchased 9/5/86-3/31/87. Product prices above are suggested list prices.

---

*Rub the silver box to reveal whether you win a prize or get a rebate coupon. Then fill in the second-chance entry blank to the right*

### *Second-Chance Sweepstakes Entry!*

We're running two Second-Chance Sweepstakes drawings to award the trip and cars. They *will be won* by someone—it *could be you!* Fill in the entry coupon and mail it now. Winners will be notified immediately, because the final America's Cup races start in Australia on January 31, 1987, and you'll have to pack in a hurry.

*(You will need a valid passport and the ability to comprehend Australian versions of the English language.)*

Name _____

Address _____

City _____

State _____ Zip _____

## OFFICIAL RULES - BORLAND INSTANT WINNER GAME

**1. NO PURCHASE NECESSARY:** To participate, you may obtain a game card inserted into the October, November, December, or January issue of the following magazines: PC World; Byte; PC Tech Journal; PC Magazine. You may also obtain a game card by mailing a self- addressed, stamped envelope to: Borland International Game Card, P.O. Box 870, Wilton, CT 06897 (Washington State residents send self- addressed envelope.) Limit one game card per stamped request. All requests must be received by January 15, 1987

**2. TO PLAY:** Remove the rub-off area on the game card to reveal what prize or rebate offer you have obtained.

**3. PRIZES/REBATES:** Beneath the rub-off area one of the following prizes may be revealed: Trip for Two to America's Cup Races or $10,000; 1986 Suzuki 4W Samurai Convertible or $6,895, AST Turbo Laser; Toshiba 1100 Portable Computer; Toshiba 3100 Portable Computer; AST Sinpakpremium; AST Advantagepremium; AST 3G Pak; AST Rampage; AST Rampage AT, Free Borland Product, or you may obtain the following rebate offer: $10 rebate offer on any individual product or $15 rebate offer on any single advertised Borland bundle (See rule #11 for prize details.)

**4. PRIZE CLAIMS:** If you obtain one of the prizes stated in Rule #3, sign your full legal signature on the game card and send via certified mail (copy should be made for your records) along with your name and address to: Borland International Prize Claim, 196 Danbury Road, Wilton, CT 06897. All prize claims must be received or postmarked by February 15, 1987. (See Rule #12 for Trip for Two to America's Cup exception.)

**5. REBATE CLAIMS:** Rebates are good for products purchased from September 5, 1986 through March 31, 1987. The $10 rebate is good for any individual Borland product and the $15 rebate is good for any advertised Borland software bundle. To receive your rebate you must return your completed license agreement from the manual, this game card and dated proof of purchase to: Borland International, Game Card Rebate, 4585 Scotts Valley Drive, Scotts Valley, CA 95066. Upon receipt of the license agreement, game card and proof of purchase, Borland will send your check. Rebate is not valid with any other rebate or promotion offered directly from Borland.

**6. VERIFICATION:** All game materials are subject to verification. Game materials are void and will be rejected if not obtained through authorized, legitimate channels, and may be rejected if any part is reproduced, counterfeited, torn or altered in any way, or if materials contain printing, typographical, or mechanical errors. Decisions of the Redemption Center are final. Game pieces from any game other than the Borland Instant Winner Game may not be used in this game.

**7. CONDITIONS OF PARTICIPATION:** Material submitted becomes the property of Borland International. The submission of game pieces is the sole responsibility of the individual seeking verification, who is solely responsible for lost, late, or misdirected mail. All taxes, registration and inspection fees are the sole responsibility of the verified winner. Winners may be required to execute an affidavit of eligibility and name and likeness publicity release. By participating in the game you accept and agree to be bound by these rules and the decision of the Official Redemption Center which will be final.

**8. ELIGIBILITY:** Participation is open solely to residents of the United States 18 years of age and over, except employees and agents of Borland International, service agencies, and individuals engaged in the development, production, or distribution of game materials, The Merritt Group, Inc. and their immediate family or members of their households. Void in Vermont and where prohibited by law.

**9. GAME SCHEDULE AND AWARD OF PRIZES:** The Borland Instant Winner Game will commence on or about September 5, 1986 and end on January 30, 1987. It will officially end, however, when all game pieces are distributed. Verified game prizes will be awarded within thirty (30) days from the date of their receipt for verification at the Official Redemption Center. A major prize winners' list can be obtained by sending a stamped, self- addressed envelope to: Borland Instant Winner Game Winners' List, P.O. Box 7089, Wilton, CT 06897

**10. DOOR CHART:** The odds of winning prizes are based upon obtaining the one rare game piece among the applicable number of game pieces.

| PRIZE | Qty. | Total Value | Odds of Winning |
|---|---|---|---|
| Trip for Two to America's Cup or $10,000 | 1 | $ 10,000.00 | 1 in 6,458,000 |
| Suzuki 4W Samurai Convertible JA or $6,895 | 2 | $ 13,790.00 | 1 in 3,229,000 |
| AST Turbo Laser | 1 | $ 4,995.00 | 1 in 6,458,000 |
| Toshiba Portable Computer | 2 | $ 8,896.00 | 1 in 3,229,000 |
| AST Memory Boards | 25 | $ 15,025.00 | 1 in 258,320 |
| Borland Products | 1,000 | $149,000.00 | 1 in 6,458 |
| OVERALL TOTAL | 1,031 | $199,708.00 | 1 in 6,264 |

All remaining game cards will contain a $10 rebate good on any individual Borland product or a $15 rebate good toward any advertised Borland software bundle.

**11. PRIZE DETAILS:** Trip for two to America's Cup Races (or $10,000) will include coach seating round trip airfare on regularly scheduled commercial airline from San Francisco, California to Perth, Australia and up to two weeks hotel accommodations in Perth, Australia plus $4,500 spending cash. Winners will be responsible for obtaining visa, passport, and all other travel documents. Trip does not include meals, taxes, excess baggage charges and other hotel charges. Minor must be accompanied by parent or legal guardian.

Suzuki 4W Samurai Convertible JA Standard Equipment Package (or $6,895), verified winner will be responsible for all registration, insurance, and licensing fees. AST Turbo Laser; Toshiba Portable Computer Model #T1100; Toshiba Portable Computer Model #T3100, AST Memory Boards and Free Borland Products are non- substitutional except by sponsor due to product availability and all warranties and guarantees are subject to manufacturers terms. All prizes are non- transferable. Winning consumer is responsible for all local, state and federal taxes.

**12. RECOND CHANCE SWEEPSTAKES:** There are two Second Chance Sweepstakes drawings scheduled to be conducted on December 31, 1986 and February 28, 1987. Random drawing from all entries received by December 30, 1986 will award trip for two to America's Cup Races (or $10,000). Random drawing from all entries received by February 28, 1987 will award two (2) Suzuki 4W Samurai (or $6,895). All remaining prizes that are unclaimed after February 15, 1987 will remain unclaimed. Send entry to: Second Chance Entry P.O. Box 870 Wilton, CT 06897

**If you have any questions concerning the Borland Instant Winner Game, call: 1-800-451-4471.**

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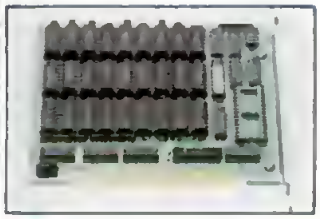

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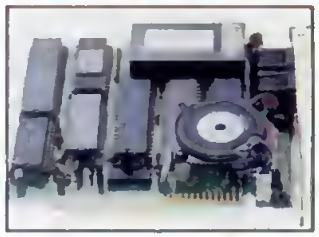
Logic (Hayes Comp.) 1200 Baud External Modems . 179
Logic (Hayes Comp.) 2400 Baud External Modem . . 309



Logic (Hayes Comp.) 1200B Internal Modem with Mirror (Crosstalk Clone) Software . . . . . 129
Logic 2400B Internal Modem 2400B w/Software . . . . . 299

**PROMETHEUS**
Pro-modem 1200 . . . . . 279
Pro-modem 1200B w/software . . . . . 239

**TOSHIBA**
1200B Lap-Top Modem (T1100 Plus) . . . . . 329

**VEN-TEL**
PC Modem 1200 Half Card . 359
1200 Plus . . . . . 329
PC Modem 2400 Half Card . 469

## MOUSE INPUT DEVICES

**MOUSE SYSTEMS**
PC Mouse w/DR Halo 2 . . Special

**MICROSOFT**
Microsoft Mouse (Serial) . . $135
Microsoft Mouse (Buss) . . . 125

## SURGE PROTECTORS

**KENSINGTON MICROWARE**

Masterpiece Plus . . . . . $119

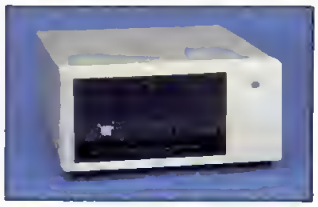
**CURTIS**
Diamond . . . . . 39
Emerald . . . . . 45
Ruby . . . . . 59

## KEYBOARDS

**KEYTRONIC**
5151 (Deluxe) . . . . . $169
5153 (w/touch Pad) . . . . . 279
3270 PC . . . . . 235
5151 (AT&T) . . . . . 189
Keytronic Jr. 5151 . . . . . 169

## MEMORY STORAGE

**IOMEGA**
Bernoulli Box (10 + 10) . . . $1999



Bernoulli Box (20 Mb) . . . . 1899
Bernoulli Box (20 + 20) . . . 2499
Bernoulli Box Plus . . . . . 4199

## HARD DISK DRIVES

**MOUNTAIN COMPUTER**
Hard Drive Card (20 Mb) or (30 Mb) . . . . Low Price Call!

**PRIAM CORP**
60 Mb Internal Hard Drive . . . . . 1389
Innerspace ID 40 Mb . . . . . 1349

**PLUS +**
Hard Card 10 Mb . . . . . 620

Hard Card 20 Mb . . . . . 675

**SEAGATE**
10 Mb ½ Ht Int . . . . . 465
20 Mb ½ Ht Int . . . . . 489
30 Mb ½ Ht Int . . . . . 539
20 Mb Full Ht (AT) . . . . . 599
30 Mb Full Ht (AT) . . . . . 749
40 Mb Full Ht (AT) . . . . . 879
80 Mb Full Ht (AT) . . . . . 1349

**CORE**
20 Mb Int (AT) . . . . Low Price Call!
30 Mb Int (AT) . . . . Low Price Call!
40 Mb Int (AT) . . . . Low Price Call!
72 Mb Int (AT) . . . . Low Price Call!

## CARTRIDGE TAPE BACK-UP

**EVEREX**
Excel Stream 20 Mb Int . . . . $639
Excel Stream 60 Mb Int . . . . 799
Excel Stream 60 Mb Ext . . . 929

**IRWIN**
Irwin 110 10 Mb Int . . . . . 499
20 Mb Int . . . . . 595
20 MB 325 (AT) Ext. D . . . . . 779

**LOGICSOFT**

Logic 60 Mb Internal Cartridge Tape Backup Kit . . . . . 725
Logic 25 Mb Internal Cartridge Tape Backup Kit . . . . . 569

**SYSGEN**
Image Tape Backup 10 Mb Int . . . . . 789
Image Tape Backup 20 Mb Int . . . . . 599
Image Tape Backup 20 Mb Ext . . . . . 649

**TECMAR**
QIC 60 AT . . . . . 1239
QIC 60 Ext Tape Backup . . . 1579

**CORE**
60 Mb Ext . . . . . 1599

## FLOPPY DISK DRIVES

Panasonic 360 K ½ Ht. . . . . $119
Tandon TM-100 360 K F/Ht. . 125
Tandon TM-100 360 K ½ Ht. 105
Toshiba 360 K ½ Ht. . . . . 115

## BACK UP POWER SUPPLIES

**DATA SHIELD**
200 Wt (PC) . . . . . $249
300 Wt (XT) . . . . . 359

500 Wt (AT) . . . . . 569
800 Wt (AT) . . . . . 635

*Due to weight restrictions, Printers and Monitors and some misc. bulk items are shipped UPS—free All prices and policies subject to change without notice.

*TGA mode (640 x 400)*

# Buy one. Get two free.

*EGA mode (640 x 350)*

*Improved CGA text mode*

Sometimes life gives you less than you bargained for. Taxan would like to even that out a bit by giving you more than you'd expect—our Multi-Resolution System.™

Our display products not only give you EGA software compatibility, but also switch modes to CGA or TGA (640x400). This eliminates the hassles of swapping adapter cards or resetting internal switches. And, at the same time, it gives you three modes for the price of one.

Because of its ability to automatically switch modes, the Taxan Gold Card™ graphics adapter allows you to add new programs, with different display standards, to your software library without the worry of compatibility.

The Taxan Gold Card is also equipped with a built-in serial port. Making it easier to use mouse-driven software, like Windows, without buying a separate board or giving up valuable expansion slots in your PC.

| *Graphics Mode* | |
|---|---|
| TGA | Ultra-high resolution (640x400) |
| EGA | IBM standard (640x350) |
| CGA | Double scanned, high-quality image |

| *RGB Monitor Applications* | |
|---|---|
| Model 840 | 16-inch, large-screen CAD/CAM graphics. 0.39 mm dot pitch |
| Model 635 | Superior text display and business graphics |
| Model 650 | Personal CAD/CAM graphics. 0.28mm dot pitch |

Best of all, the Taxan Gold Card is designed to complement our high performance RGB monitors. Like the new large-screen model 840 or the improved models 635 and 650. The higher-than-industry standard horizontal scan rate of 25 KHz, and a doubled line count of 640x400 combine to give you sharp, clean text. Bright, clear colors. And crisp chart titles. All without annoying flicker.

Taxan's Multi-Resolution System is fully compatible with popular IBM and IBM-compatible PCs, including the AT&T 6300 and 6300 Plus.

Give us a call at your regional Taxan office for performance data on the Multi-Resolution product family. And remember that the best things in life are free.

TAXAN

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Taxan Midwest (312) 299-1060. Taxan West (818) 810-1291.

Multi-Resolution System and Taxan Gold Card are trademarks of Taxan USA Corporation.

CIRCLE 493 ON READER SERVICE CARD

*Comes with free DS Backup—*
*a $69.95 value*

# Announcing 7 different Express Hard DiskCards™ from 20 to 60 megabytes starting at $449—including an internal Hard DiskCard with automatic backup for your IBM AT®

## Complete Systems

Each Hard DiskCard comes complete with everything you need, installs in minutes, boots off the hard disk, has a programmable interleave factor of up to 1-to-1,*** and has plated media. You can add it to an existing hard disk and, for an extra $95, have both disks act as one.

## Easy Installation

If you're someone who hates reading installation manuals or who gets intimidated installing internal disk drives, one of the Express Hard DiskCards™ is for you. Simply insert it inside your IBM®PC, XT, AT or compatible, like any other add-on card.

## High Performance

Express Hard DiskCards give you from 20 to 60 megabytes of rigid disk storage, and something more. The controller comes with a programmable interleave factor of up to 1-to-1, which means that you retrieve data up to 6 times faster than the PC XT which has a 6-to-1 interleave controller.

## Access Speed

The Express Hard DiskCards, with an average access speed of 60 msec, gives you—in addition to that extra speed—head retraction. Before you start thinking you've just got to have head retraction, you should know that the 80 msec Express Hard DiskCards are rated at 50 g's power off and 10 g's power on. Furthermore, our 80 msec Hard DiskCards, like all Express Hard DiskCards, have plated media. Most hard disks-on-a-card have iron oxide (it looks and acts like rust), which means if the head hits the iron oxide, it will gouge out media and your data along with it. Plated media, on the other hand, looks like a car's chrome bumper. If the head hits, it will cause little or no damage. That's why Express offers drives with high g tolerances.

All of the benefits of our 80 msec drives aside, you may want to get our 60 msec drive just for the extra speed. But in addition to increased access speed, you'll be getting automatic head retraction.

## 50 percent faster

Our 30 and 60 megabyte Hard DiskCards give you more storage space, but in addition, they also give you a transfer rate of 7.5 megabits per second—a full 50 percent faster than an IBM XT or AT hard disk. Faster speed is important, and becomes more so if you want to combine disks.

## One File, Two Disks

With Express Systems' new Coalesce™ Software, you can add our 20 or 30 megabyte Hard DiskCard™ to your existing hard disk. They will both work together as though they were one disk—up to 144 megabytes worth.

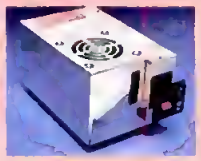
Coalesce not only merges the two hard disks together, it bypasses the DOS barrier of 32 megabytes. That means that if you already own a 114 megabyte hard disk, you can add our 30 megabyte Hard DiskCard and have a total of 144 megabytes as a single file!

However, if you don't have a

| Features | Models 20AT** | 2080 | 2060 | 3080 | 3060 | 4080 | 6060 |
|---|---|---|---|---|---|---|---|
| Capacity formatted | 20.05MB | 20.00MB | 20.05MB | 30MB | 30.08MB | 40.00MB | 60.16MB |
| Transfer rate | 5Mbits/sec* | 5Mbits/sec | 5Mbits/sec | 7.5Mbits/sec | 7.5Mbits/sec | 5Mbits/sec | 7.5Mbits/sec |
| Avg. access time | 60msec | 80msec | 60msec | 80msec | 60msec | 80msec | 60msec |
| Slots | 1½§ | 1½ | 1½ | 1½ | 1½ | 2 | 2 |
| Media | Plated | Plated | Plated | Plated | Plated | Plated | Plated |
| Warranty | 1 year | 90 days | 1 year | 1½ years | 2 years | 2 years | 2 years |
| Head lifter | automatic | manual | automatic | manual | automatic | manual | automatic |
| Price | $449 | $495 | $595 | $695 | $795 | $995 | $1,095 |

IBM is a registered trademark of the International Business Machines Corporation, Compaq ie e registered trademark of Compaq Computer Corp., Leading Edge is a registered trademark of Leading Edge Products

**Discover why companies like AT&T, IBM, Bell Labs, Polaroid, Kodak, 3M, JC Penney, Sperry, Hughes Aircraft, Stanford University, Allied Corp, the Associated Press and others have bought Express Hard DiskCards.™**



## Complete Hard Disk Kits—(all transfer rates 5 Mbits/sec)

| Formatted Storage Capacity in Mbytes | Height | Plated Media | Average Access | Comments | PC or PC/XT | AT |
|---|---|---|---|---|---|---|
| 10 | ½ | no | 85 msec | Low power | $ 295 | N/A |
| 21 | ½ | yes | 85 msec | Low power | Call | Call |
| 32 | Full | no | 30 msec | CDC WREN II drive | $1,295 | $1,195 |
| 72 | Full | no | 25 msec | Ideal AT drive for LAN | $1,795 | $1,695 |
| 144 | Full | no | 30 msec | 2 72MB drives as one volume | † | $3,395 |
| **Removable Hard Disk** | | | | | | |
| 10 | ½ | yes | 90 msec | 5 Mbits/s | $1,095 | $1,095 |

## Tape Systems and Subsystems

| Formatted Storage Capacity | Height | Data Transfer Rate (k sec) | PC or PC/XT | AT |
|---|---|---|---|---|
| 60 Mbytes | ½ | 88 | $ 795 | $ 795 |
| 60 Mbytes Subsystem | | 88 | $ 1,045 | $ 1,045 |
| 21 Mbytes (unformatted) Start/stop Subsystem | | 24 | $ 445 | $ 445 |
| 26 Mbytes Floppy Tape* Subsystem | | 31 | $ 695 | $ 695 |

**Controllers**
All of our hard disk and tape controllers are available separately. Please call for prices.

**Subsystem Chassis†**
Any of our disk or tape units are available in an external subsystem for an additional $250.00. You can mix & match any of our ½ high hard disks or tape drives together or add any single full height hard disk.

**Power Supply**
150 Watt Power supply $75.00‡

‡with any purchase of PC or PC XT replacement

hard disk now and want 40 or 60 megabytes of hard disk storage, then our Express Double DiskCard** comes with two hard disks. You can use one disk to back up the other with our automatic backup software *Auto DiskSave*™ or for an extra $95, you can buy Coalesce and have both disks work as one.

## Free backup program

All Express Hard DiskCards are available with a free backup program, DS Backup.** This easy and convenient program—a $69.95 value—makes backing up simple and fast. And to receive it, all you have to do is ask for it when you order.

## AT Backup DiskCard™

How would you like to know that your IBM AT's hard disk is always backed up without having to think about it. With Express Systems' AT Backup DiskCard™ you can have 20 megabytes of hard disk backup on a card without taking up valuable front panel space. The AT Backup DiskCard comes with Auto DiskSave software, so you can backup by date, time, archive bit (since you last used a file), by subdirectory, file name or groups of files, or any name combination using DOS wild cards. Furthermore, you can schedule your backup for anytime you return to DOS, or at specific times.

If you're worried about 20 megabytes not being enough space, we include Express Systems file compression software, File Compactor,™ which compress binary files 30-35 percent, text files 40-50 percent, and data base files up to 90 percent of their original space. And not only will you not have to think about backing up your files, the AT Backup DiskCard will do it file-by-file at the rate of 3 megabytes per minute.

## Compatibility

The Express Hard DiskCard is compatible with most IBM PC or XT compatible computers, including but not limited to, all Leading Edge®, all Compaq® computers, AT&T 6300, Sperry, Zenith, Epson, and most others. And all of the cards can work with the IBM PC's 65 watt power supply.

## Upgradable

If you already own an Express Systems Hard DiskCard, you can upgrade to any of our larger Hard DiskCards. Call for details.

## Warranty

The Express Hard DiskCard comes with a 90 days to two year warranty, depending on the model.

## Quick Delivery

Order today and you'll receive your Hard DiskCard by Federal Express®. The next day or the day after—you decide.

For the best buy in a convenient, easy to install hard disk, call Express Systems.

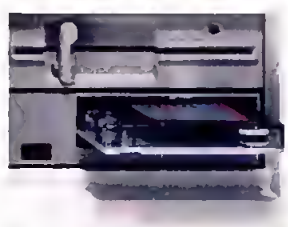
*Uses IBM AT or compatible controller.
**Available only for the IBM AT or compatible.
***For IBM AT and compatibles, the interleave factor is dependent on its controller.
§Takes up 1½ slots and works beside any ½ slot board such as floppy controller.

EXPRESS SYSTEMS

**Call Toll Free 1-800-341-7549 Ext. 3500**
**In Illinois, call (312) 882-7733 Ext. 3500**

Express Systems, Inc., 1254 Remington, Schaumburg, IL 60195

CIRCLE 380 ON READER SERVICE CARD



AT Backup DiskCard, Express Hard DiskCard, Double DiskCard, Coalesce, File Compactor, and Auto DiskSave are trademarks of Express Systems, Inc.

# Softline PRICE BUSTERS

| Lotus 1-2-3 | Paradox | dBase III Plus | FrameWork II | Multimate Advantage | Word Perfect 4.1 |
|---|---|---|---|---|---|
| $319 | $469 | $389 | $389 | $279 | $209 |

## Software

### Word Processing

| | |
|---|---|
| FANCY FONT | $139 |
| FINAL WORD II | $219 |
| MICROSOFT WORD 3.0 | $279 |
| MULTIMATE | $249 |
| MULTIMATE ADVANTAGE | $279 |
| OFFICE WRITER/ SPELLER | $239 |
| PFS: WRITE | $ 69 |
| SAMNA WORD III | $279 |
| THINK TANK | $109 |
| TURBO LIGHTNING | $ 65 |
| VOLKSWRITER 3 | $159 |
| VOLKSWRITER SCIENTIFIC | $259 |
| WORD PERFECT 4.1 | $209 |
| WORDSTAR 2000 | $249 |
| WORDSTAR 2000 + | $289 |
| WORDSTAR PRO | $259 |
| XYWRITE III | $199 |

### Database Systems

| | |
|---|---|
| CLIPPER | $359 |
| CONDOR III | $339 |
| DBASE III PLUS | $389 |
| KMAN 2 | $339 |
| PARADOX | $469 |
| PFS: FILE/ REPORT | $189 |
| Q&A | $249 |
| QUICKCODE III | $159 |
| QUICKREPORT | $159 |
| R BASE SYSTEM V | $359 |
| REFLEX | $ 89 |
| REVELATION | $499 |

### Spreadsheets/ Integrated Packages

| | |
|---|---|
| ENABLE | $349 |
| FRAMEWORK II | $389 |
| JAVELIN | $419 |
| LOTUS 1-2-3 | $319 |
| MULTIPLAN | $135 |
| OPEN ACCESS II | $299 |
| SMART SYSTEM | $439 |
| SPREADSHEET AUDITOR | $ 99 |
| SUPERCALC 4 | $289 |
| SYMPHONY | $449 |
| TWIN | $ 79 |

### Graphics

| | |
|---|---|
| CHARTMASTER | $219 |
| DIAGRAPH | $309 |
| DIAGRAM MASTER | $199 |
| ENERGRAPHICS 2.0 | $299 |
| FREELANCE | $209 |
| GEM DRAW | $149 |
| GRAPHWRITER COMBO | $309 |
| IN A-VISION | $259 |
| MAPMASTER | $239 |
| MS CHART | $189 |
| PC DRAW | $209 |
| PC PAINTBRUSH | $ 99 |
| PFS: GRAPH | $ 89 |
| PICTURE PERFECT | $245 |
| SIGNMASTER | $149 |
| WINDOWS/DRAW | $119 |

### Project Management

| | |
|---|---|
| HARVARD TOTAL PROJECT MANAGER | $279 |
| MICROSOFT PROJECT | $249 |
| PROJECT SCHEDULER NETWORK | $339 |
| SUPERPROJECT + | $269 |
| TIMELINE 2.0 | $239 |

### Communications/ Productivity Tools

| | |
|---|---|
| CARBON COPY | $ 129 |
| CROSSTALK | $ 99 |
| PROKEY | $ 85 |
| RELAY GOLD | $ 149 |
| REMOTE | $ 109 |
| SMARTERM | $Call |
| SMARTCOM II | $ 99 |
| SUPERKEY | $ 55 |

### Statistics

| | |
|---|---|
| SPSS/PC + | $899 |
| STATGRAPHICS | $449 |
| STATPAC GOLD-WALONICK | $399 |
| SYSTAT—NEW | $499 |

### Accounting

| | |
|---|---|
| BPI | $309 |
| GREAT PLAINS | $479 |
| IUS EASYBUSINESS | $309 |
| ONE WRITE PLUS | $159 |
| OPEN SYSTEMS | $409 |
| REAL WORLD | $399 |
| STAR ACCOUNTING PARTNER II | $529 |

### Network Applications

| | |
|---|---|
| DBASE III LAN PAK | $599 |
| KMAN 2 | $899 |
| MULTIMATE | $639 |
| MULTIMATE ADVANTAGE | $749 |
| OPEN SYSTEMS | $459 |
| RBASE 5000 | $799 |
| REVELATION | $999 |
| SAMNA WORD III | $799 |
| WORD PERFECT SERVER | $309 |
| WORD PERFECT STATION | $ 75 |

### Language Compilers

| | |
|---|---|
| C86 C COMPILER | $ 319 |
| COPYWRITE | $ 45 |
| FASTBACK | $ 89 |
| LATTICE C | $ 259 |
| MICROSOFT C COMPILER | $ 299 |
| MS BASIC COMPILER | $ 249 |
| MS FORTRAN | $ 229 |
| NORTON UTILITIES | $ 59 |
| QUICK BASIC | $ 89 |
| TURBO PASCAL | $ 69 |
| TURBO PROLOG | $ 69 |
| XENIX | $Call |
| ZERO OISK | $ 70 |

### Desktop Environments

| | |
|---|---|
| DESOVIEW | $69 |
| GEM DESKTOP | $39 |
| MS WINDOWS | $69 |
| SIDEKICK | $48 |

## Hardware*

### Multifunction Boards

| | |
|---|---|
| AST ADVANTAGE (128K) | $349 |
| AST 6 PAK PLUS (64K) | $189 |
| AST I/O MINI | $139 |
| AST MP MINI | |
| AST PREMIUM PAK (512K) | $359 |
| AST RAMPAGE PC | $249 |
| AST RAMPAGE AT | $459 |
| AST SHORTRAM (0K) | $159 |
| INTEL ABOVEBOARD PS AT | $399 |
| JRAM AT-3 (0K) | $239 |
| JRAM 3 (0K) | $179 |
| ORCHID CONQUEST (0K) | $279 |
| ORCHID ECCEL (0K) | $399 |
| PC TURBO 286 (1MB) | $799 |
| PC TINY TURBO 286 | $459 |
| QUADBOARD (64K) | $139 |

### Display Boards

| | |
|---|---|
| HERCULES GRAPHICS CARD | $199 |
| HERCULES COLOR CARD | $159 |
| PARADISE MODULAR GRAPHICS | $259 |
| QUADRAM EGA + | $369 |
| SIGMA COLOR 400 | $449 |
| STB EGA PLUS | $299 |
| TECMAR EGA MASTER | $299 |
| TSENG ULTRA PAK | $429 |
| TSENG EVA-CM II | $379 |
| TSENG EVA 480 | $Call |

### Emulation Boards

| | |
|---|---|
| AST 5211-11 + | $649 |
| AST 5251-12 | $499 |
| AST BSC | $489 |
| AST SNA | $599 |
| IRMA | $725 |
| SMART ALEC 5251 | $899 |

### Modems

| | |
|---|---|
| AST REACH 1200 | $359 |
| HAYES 1200 | $389 |
| HAYES 1200B | $349 |
| HAYES 2400 | $579 |
| HAYES 2400B | $549 |
| TRANSNET 1000 | $279 |
| VENTEL 1200 HALF CARD | $389 |
| VENTEL 1200 PLUS | $299 |
| WATSON | $339 |

### Mass Storage/Backup

| | |
|---|---|
| IOMEGA 10 + 10 W/INTFC | $1999 |
| IOMEGA 20 + 20 W/INTFC | $2599 |
| IRWIN 120D 20MB TBU | $ 599 |
| IRWIN 145AT 40MB TBU | $ 699 |
| MOUNTAIN DRIVECARD 20MB | $ 719 |
| PLUS HARDCARD 10MB | $ 569 |
| PLUS HARDCARD 20MB | $ 719 |
| PRIAM 42MB AT | $949 |
| SYSGEN SMART IMAGE 20MB (INT) | $ 825 |
| TALLGRASS | $ Call |
| TECMAR OIC-80AT TBU (INT) | $1199 |

### Monitors

| | |
|---|---|
| AMDEK 310A | $159 |
| AMDEK 600/722 | $429/539 |
| NEC MULTISYNC | $819 |
| PRINCETON HX-12 | $449 |
| PRINCETON MAX-12E | $179 |
| PRINCETON SR-12 | $499 |
| PRINCETON HX-12E | $539 |
| PRINCETON HX-9 | $529 |
| TAXAN 122 AMBER | $159 |
| TAXAN 630/640 | $469/539 |

### Networks

| | |
|---|---|
| AST PC NET | $Call |
| NOVELL | $Call |
| ORCHID PC NET | $Call |

### Printers/Plotters

| | |
|---|---|
| BROTHER TWINWRITER | $ 939 |
| DATA PRODUCTS | $Call |
| DIABLO 635 | $1149 |
| EPSON FX-85 | $ 399 |
| EPSON FX-286 | $ 579 |
| EPSON LO-800 | $ 589 |
| EPSON LO-1000 | $ 789 |
| HP 7475A | $ Call |
| NEC 3550 | $ 799 |
| OKIDATA 192 | $ 379 |
| OKIDATA 193 | $ 519 |
| OKIDATA 292 | $ 539 |
| OKIDATA 293 | $ 689 |
| TOSHIBA P321 | $ 499 |
| TOSHIBA P341 | $ 829 |
| TOSHIBA P351 | $1069 |

### Input Devices

| | |
|---|---|
| KEYTRONICS 5161 | $169 |
| KEYTRONICS 5153 | $299 |
| MICROSOFT MOUSE | $129 |
| PC MOUSE W PAINT + | $139 |

### Accessories

| | |
|---|---|
| CURTIS SURGE PROTECTORS | $Call |
| DATASHIELD BACKUP POWER | $Call |
| DATASHIELD SURGE PROTECTORS | $Call |
| GILTRONIX SWITCHES | $Call |
| MASTERPIECE PLUS | $ 135 |
| MICROFAZER INLINE BUFFERS | $Call |
| 256K RAM SET | $ 39 |
| 8097 MATH CHIP | $ 119 |
| 80287 MATH CHIP | $ 189 |

*CALL FOR SHIPPING COSTS

| NEC Multisync | Mountain Drivecard 20 | Quadram EGA+ | Hayes 1200B Halfcard | JRAM AT-3 | IRMA Board |
|---|---|---|---|---|---|
| $619 | $719 | $369 | $349 | $239 | $725 |

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■ STEWART ALSOP

# THE POWER DESK

*By a factor of about 10 to 1, American offices contain more desktops than desktop PCs. The next step is to integrate the two in a true power-user configuration.*

At Businessland's recent conference on connectivity, which the national sales company holds every year for its customers, one of Businessland's executives started talking about desktops. There are more than 60 million desktops in American offices, he noted, but just 6 or 7 million desktop computers. "Maybe we should forget about computers," he said, "and start selling desks."

What a brilliant idea! At the time, I was sitting with Joe Walker, a micro manager for a Boston investment house, and Ken Scott, president of a start-up computer company in Seattle. I could see that the same light bulb went on in their heads, too.

Perhaps the key to getting computers accepted in business is to build them into desks: in effect, to disguise the computer as a desk, something that every office worker knows and feels comfortable with. Feeling a growing sense of excitement, we began scribbling designs for our computer desk. (On cocktail napkins, of course, which are the preferred medium for true entrepreneurs. We've saved some of the best for our ads, for after we go public.)

Think of the possibilities. No more concerns about the "footprint" (the amount of space a computer takes up), since the desk *is* the computer. No more concerns about expandability, since you can always find more room in a desk.

**EASILY CLONED** As we scribbled, we realized that designing a simple PC into a desk wasn't that challenging and could be easily cloned. So we raised our sights and developed the concept of the Power Desk (trademark applied for). Now this is hot. We started with the idea of replacing a tier of drawers in our desk with a card cage. In a standard 32-inch desk, that would leave enough room for about 16 card slots. To power that many cards, the desk will need at least a 1-megawatt power supply. (A status option would be a two-tier desk with a capacity of 32 cards, a 2-megawatt power supply, and a big electrical throw switch. Think of being the first one in your office with a desk that dims the lights every time you turn it on.)

Now we knew we were onto something, a desklike computer with unlimited power and expandability. Obviously, anybody that would use as many as 32 cards would want access to multiple architectures. So we started with an Intel 80386 processor running DOS and UNIX. Then we added a Motorola 68030 with a dual bus for running Macintosh and Sun software, and threw in a VAX bus for good measure. To run all that operating software, we figured the desk would need at least a 100-megabyte hard disk. But, since we're going for the moon here, we decided to be safe and make it a 500-megabyte disk drive. Then we added 32 megabytes of memory. All of this circuitry is built into the desktop itself, quite a triumph of ergonomic design.

Since we were making the preliminary design decisions on the Power Desk at a conference on connectivity, we figured we better make this thing connect to anything that moves. So we gave the desk its own 3274 cluster controller, which makes the Power Desk the ultimate MIS product: anybody in the office that wants access to the mainframe goes through your desk, so you can make sure there's no funny stuff going on. And then we designed in the ROMs and controllers to handle every network standard (and substandard) we could think of. Now you can set up a local area network entirely within your own desk: no more messy cables or politics over passwords and file maintenance.

**THE CLINCHER** This was all well and good, but Joe, Ken, and I really wanted a clincher, something that would differentiate this product completely and ensure that the cloners would never catch up. Then we got it: portability. But not your old-style portability that requires the arms of an offensive guard. Instead, we decided to put the Power Desk on wheels. To ensure that our true power users would never have to be embarrassed by using a wimpy little mouse, we designed a switchable steering

Illustration: John Hale

■ STEWART ALSOP

wheel and accelerator pedal. In Cursor mode, the wheel-and-pedal assembly steers you around the screen. In Drive mode, it steers you around town.

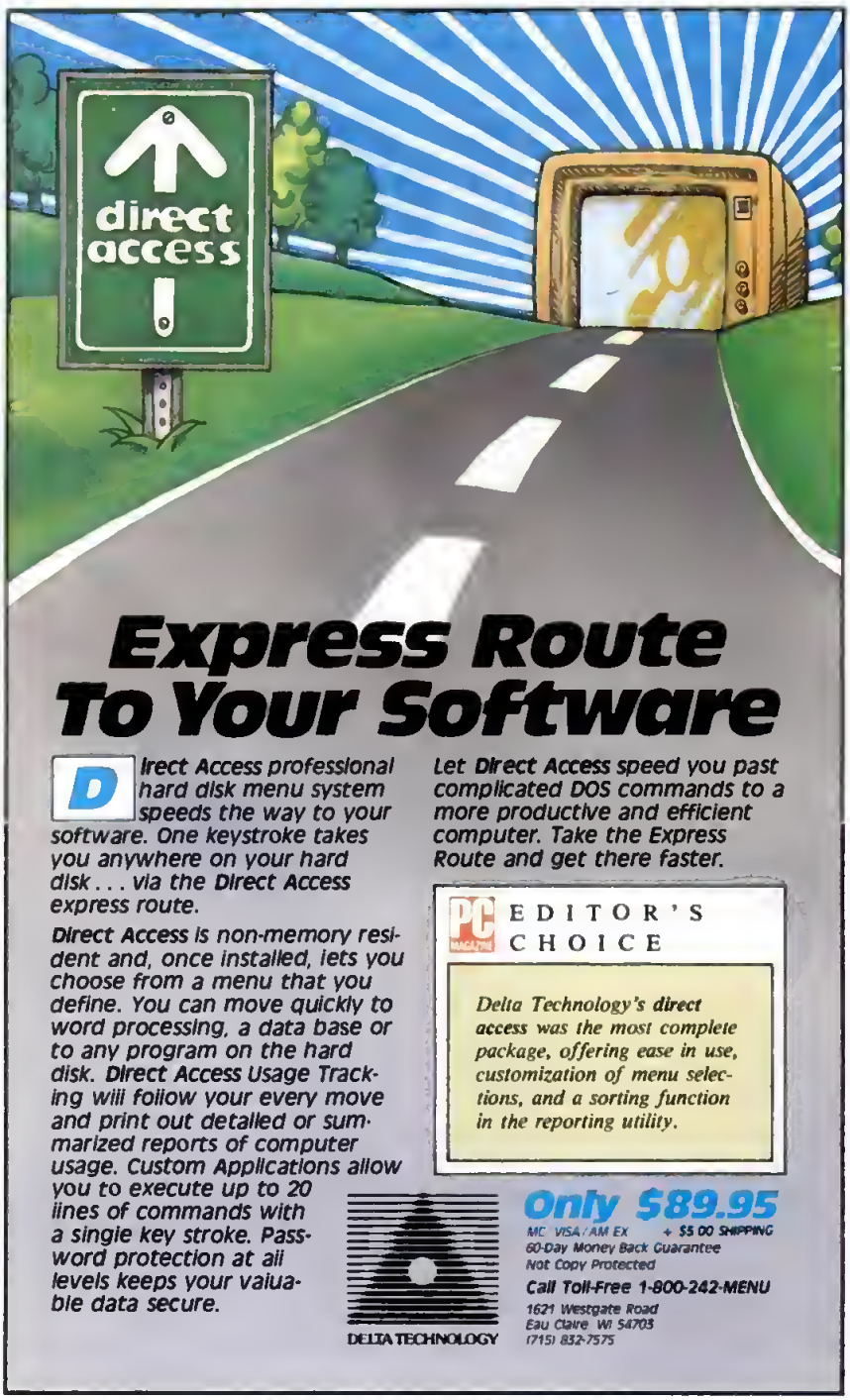
For the display, we decided to forget all this rigmarole about icons and fake desktops and borrow a little technology from the U.S. Air Force. We've designed a cockpit for the user with a proprietary controller (which can emulate monochrome, Hercules, color graphics, and enhanced graphics modes) that projects a 3-D, heads-up display on the windshield. (We're getting a little interference from the windshield wiper, but we'll have that licked by next week.) This display can show you what's going on in each emulation mode simultaneously.

Then we finally got the ultimate concept. Why not build the Power Desk into the chassis of a Mack truck? Then we could just design an oversized edge connector into the front bumper. When the user drives to work in the morning, all he would need to do is park and he would be ready to go. (We're working on a Yuppie option for a later model, where the Power Desk would be installed on the chassis of a BMW, but we're having trouble figuring out where to put the battery bank.)

■ We're working on a Yuppie option for a later model, where the Power Desk would be installed on the chassis of a BMW.

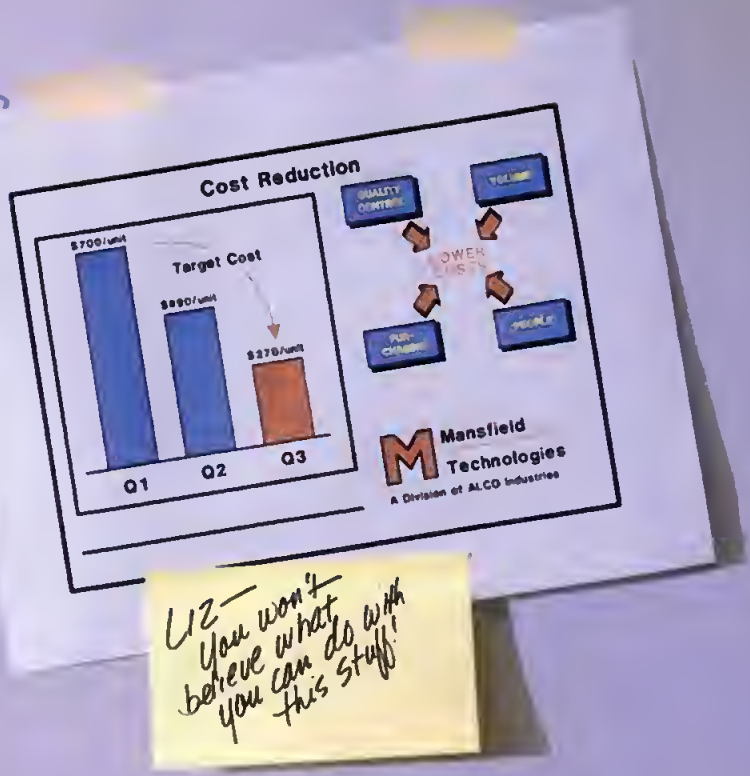
**SALES STRATEGY** Now that we've got the basic idea established, we're working on the business plan. The Power Desk is a fairly upscale product, probably retailing for around $50,000. But we've had some interest from the Ford Motor Co. in doing a joint venture for the portability chassis. We're talking to Hermann Miller about working on the form factor, in exchange for a piece of the action. (Maybe we can get John DeLorean to set up the dealer network. Better yet, maybe we can get Lee Iacocca to stop jabbering about imports and sell some real American technology.) But word about the Power Desk seems to be getting around, and we've already had a few calls from venture capitalists. So if you want in on a sure thing, call me soon.

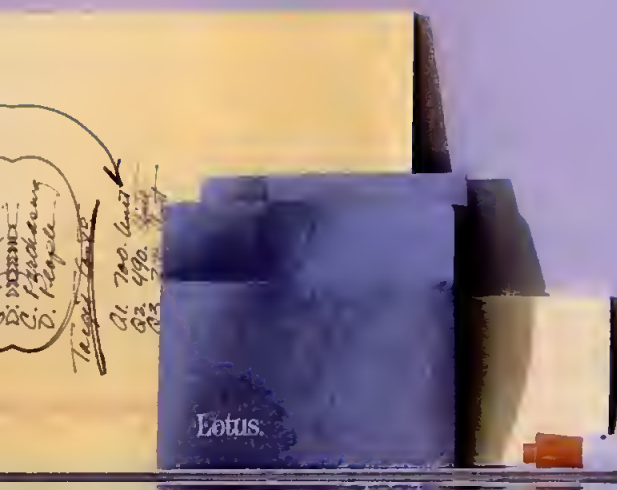
Isn't Silicon Valley a great place? PC

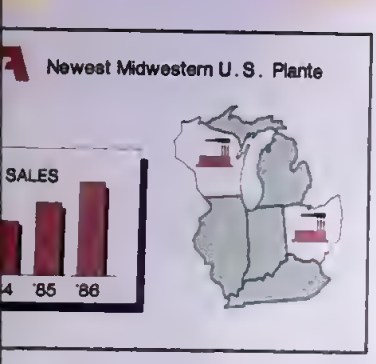


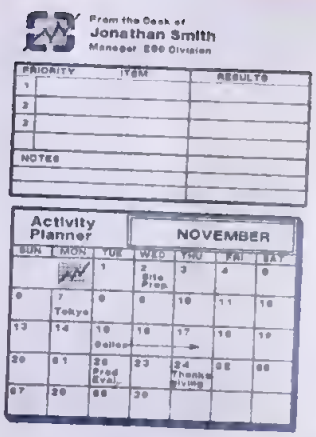
CIRCLE 256 ON READER SERVICE CARD

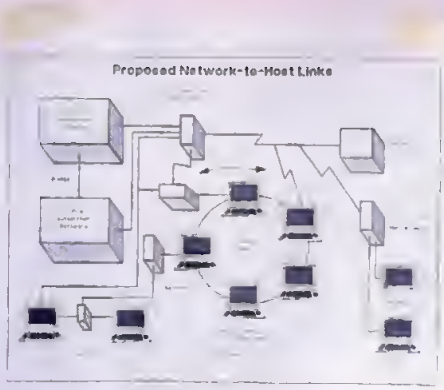
Q1
Q2
Q3


Cost Reduction
$700/unit
Target Cost
$490/unit
$270/unit
Q1
Q2
Q3
QUALITY CONTROL
Mansfield
Technologies
A Division of ALCO Industries
Liz—
You won't believe what you can do with this stuff!


Lotus.

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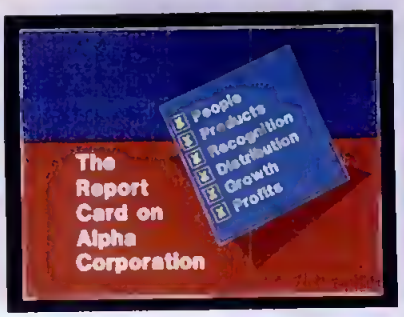
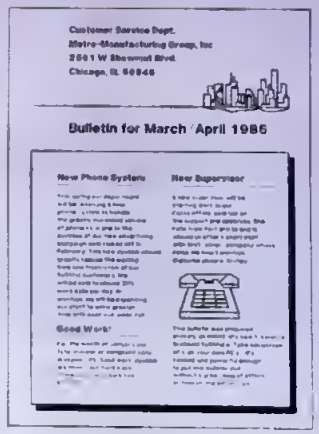
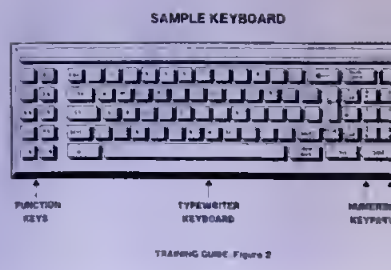
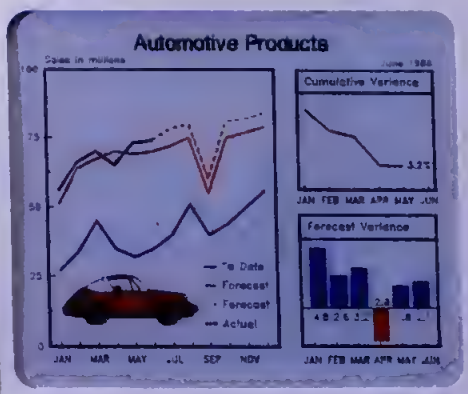



One Program
charts, symbols
diagrams, etc., etc.

overheads
+ slides, too.

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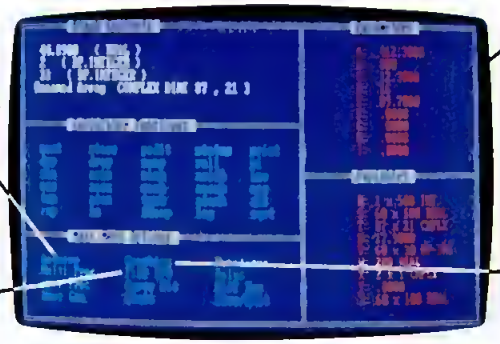

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CIRCLE 157 ON READER SERVICE CARD

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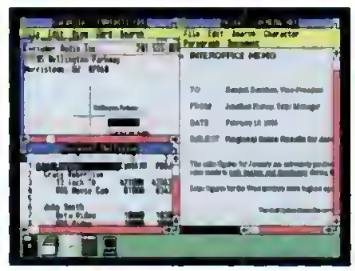

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Note: Photos show color and resolution obtained on an IBM PC equipped with an IBM Enhanced Graphics Adapter. Monochrome display is generated when an IBM Color/Graphics Adapter or compatible graphics adapter card is used.

**CIRCLE 355 ON READER SERVICE CARD**

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# THE BEST OF 1986 AND SOME OF THE WORST

Typographer David Herbick

# THE BEST OF 1986 AND SOME OF THE WORST

*To move ahead, it helps to know where you've been: the best and the worst of 1986 are the new benchmarks for success or failure in the new year ahead. Here are our findings.*

In dramatic lore they were known as Famine, Pestilence, War, and Death. These are only aliases. In 1986 their real names were the RT PC, the PC Convertible, the CMI hard disk, and the PC-XT Model 286.

IBM continued to hold the biggest market share in 1986, but it was a shrinking share as others bested Big Blue on price, innovation, and bang for the buck. It didn't help that many of IBM's new entries were clunkers.

Nineteen eighty-six was the year IBM killed the PC Portable because the PC Convertible was allegedly so much better, and Compaq came out with its Portable II, which was a bit lighter and better than the Portable 286. Then Toshiba and Zenith unleashed a trio of killer laptops, and a little bit better suddenly became not good enough.

Graphics took a big leap forward thanks to two factors: the introduction of a platoon of EGA card clones that halved the price of IBM's 2-year-old EGA, and the debut of the fabulous NEC Multisync monitor, which automatically dials in compatibility with most any graphics card on the market, including higher-than-EGA-res boards in 1987.

Nineteen eighty-six brought more and faster PCs and ATs: Compaq's Deskpro 386, which leads PCs into the 32-bit era; IBM's belated boost from 6 to 8 MHz on the AT; and a can't-tell-the-players-without-a-scorecard flood of PC and AT compatibles from just about every Japanese company that ever built a TV, VCR, stereo, printer, radar detector, or LCD wristwatch.

It was the year copy protection all but died; the year before the Year of Desktop Publishing, PC-DOS Division; yet another Year of the LAN (maybe next year?); a year of many announcements and few real advances in word processing, databases, or spreadsheets; and the beginning of the end for expensive daisy wheel printers.

Who made the most significant contributions in 1986? The most ridiculous? On the next several pages, *PC Magazine*'s editors, contributing editors, and frequent contributors pick their favorite and least favorite products of 1986.—**Bill Howard**

## Compaq Deskpro 386

You can never be too thin or too rich, Wallis Simpson once said. And you can never have too much horsepower on your desk, Compaq Computer Corp. says by unleashing the Deskpro 386.

The numbers are straightforward: 20 percent more money and 100 percent more processing speed than IBM's best AT. And that's with today's DOS and applications programs. When the operating systems and software catch up, speed gains may be tenfold.

Corporate types who buy defensively (as in "you never get fired for buying IBM") can rest assured that the Deskpro 386 is fully compatible with the 8088 and 80286 machines that came before. At the very, very worst, if IBM figures out a way to make a Big Blue 80386 box that's incompatible with all other 386s, yet compatible with previous PCs and ATs (a

tall order verging on a technical impossibility), you still have a rugged turbo AT.

The Deskpro 386 also is a symbol of the industry's increasing independence from IBM. While IBM legitimized the PC in 1981 and gave it a dose of amphetamines with the AT in 1984, the world now lives by a DOS standard more than an IBM standard, and Compaq deserves more than a little credit for providing the leadership that got us there.—**Bill Howard**

**FACT FILE: Compaq Deskpro 386, Model 40; Compaq Deskpro 386, Model 130;** Compaq Computer Corp., 20555 FM 149, Houston, TX 77070 (800) 231-0900 **List Price:** Model 40 with 1 Mbyte of RAM, 1.2-Mbyte disk drive, parallel and serial ports, 101-key keyboard, 40-Mbyte hard disk, $6,499; Model 130 with 130-Mbyte hard disk, $8,799. **Reviewed:** Volume 5 Number 20 CIRCLE 680 ON READER SERVICE CARD

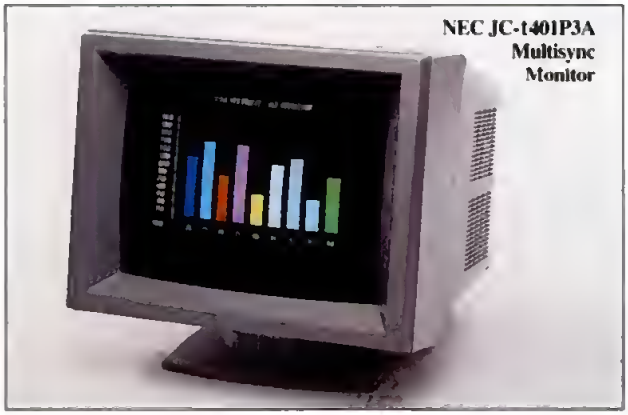
## NEC JC-1401P3A Multisync Monitor

The NEC JC-1401P3A Multisync monitor, from NEC Home Electronics (U.S.A.), is one of 1986's most innovative products and the ideal way to upgrade to the Enhanced Graphics Adapter standard. It adapts itself to virtually every kind of video signal, including some that haven't been marketed yet. It's a good way to get into graphics today, even though you know that the standard will change tomorrow: with the Multisync, you're out only the cost of the board.

Not only does the Multisync display TTL RGB signals up to 35 KHz, but it's also an analog monitor. This obsolescence-proof approach is the ideal hedge against emerging technologies. To be sure, it isn't perfect. Some video cards cause it to leave wide margins around the image, and the width adjustment is a two-position switch with minimal effect.

Making a monitor like this isn't easy: When NEC shipped the first Multisync, the product manager figured they had a 4- to 6-month lead on the competition. As of this writing, the Multisync still has no competition. Every product in this industry should be as flexible as the Multisync.—**Bill Machrone**

**FACT FILE: NEC JC-1401P3A Multisync Monitor;** NEC Home Electronics (U.S.A.) Inc., 1255 Michael Dr., Wood Dale, IL 60191 (800) 447-4700, (312) 860-9500 **List Price:** $899 **Requires:** Color graphics board. **Reviewed:** Volume 5 Number 6 CIRCLE 669 ON READER SERVICE CARD



NEC JC-1401P3A Multisync Monitor

## HAL

Imagine telling your *1-2-3* spreadsheet, "Graph this," "total all rows," or "put Jan to Jun across." Better yet, imagine *1-2-3* responding by building a graph complete with labels, summing all rows in the current part of the spreadsheet, or entering the months of the year.

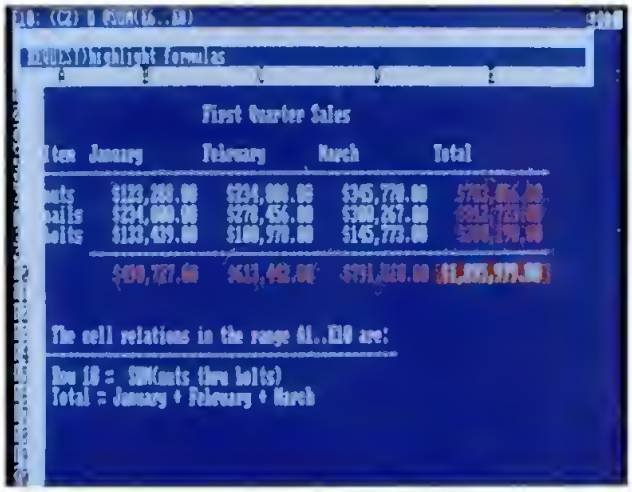
*HAL* is Lotus Development Corp.'s "natural language interface" to *1-2-3* that translates brief, conversational phrases into commands to enter formulas, move or copy data, build graphs, sort databases, and write macros. Sound a bit like artificial intelligence? It is.

For less experienced users, *HAL* is an immediate pipeline into *1-2-3*'s sophistication; for power users, *HAL* is a far faster way to manipulate information. An Undo command lets you recover from *any* mistake, even accidentally erasing the whole worksheet.

If you've ever considered using *1-2-3* as a database manager but were stymied by its unwieldiness, try again with *HAL*. *HAL* simplifies data retrieval and report writing. The *PFS:File*'s and *Q&A*'s of the world are in for some rough competition.

*HAL* moves *1-2-3* into a new dimension of power and ease of use. In fact, no *1-2-3* user should be without *HAL*. It's the best $150 you'll ever spend on a Lotus add-on.
—**Bill Howard**

**FACT FILE:** *HAL;* Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142 (617) 577-8500 **List Price:** $150 **Requires:** 512K RAM; two disk drives; *1-2-3*, Release 1A, 2, or 2.01; DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 21 CIRCLE 657 ON READER SERVICE CARD




HAL *lets you do an audit trail by highlighting formulas and listing cell relations.*

## QuickBASIC 2.0

Up until a few months ago I would have pronounced BASIC dead. Sure, BASIC is great for quick and dirty jobs, but it's missing important structural elements common in many high-level languages. You just can't write a modular structured program in BASIC.

That was before I saw

QuickBASIC 2.0. Microsoft Corp.'s QuickBASIC 2.0 adds much-needed multiline IF-THEN-ELSE constructs and CALLs to BASIC subroutines with passable parameters. (The infamous GOTO is still supported, of course, but the manual recommends that you don't use it.) Add to that QuickBASIC 2.0's DOS and BIOS software interrupt interface and full EGA graphics support, and you have one nice language.

The outside of QuickBASIC 2.0 is even fancier. You get an integrated editor with a *Windows*-like menu, in-memory compilation, and source-level debugging. Of course, the compiler still retains command-line compilation options for more-traditional programmers.

Microsoft has done a fine job with QuickBASIC 2.0 and the price is perfect. BASIC is back, and Borland better watch out.
**—Charles Petzold**

**FACT FILE: QuickBASIC 2.0;** Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073 (800) 426-9400, (206) 882-8080 **List Price:** $99; $30 for update from QuickBASIC 1. **Requires:** 256K RAM, one disk drive (two recommended), DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 15, page 46 CIRCLE 633 ON READER SERVICE CARD

## PC's Limited 286/16

The PC's Limited 286/16 is nothing short of extraordinary. It's simple: for under $3,000 you get a bolt of lightning that makes a garden variety AT look like a kiddie toy and everything else look like landfill, or something from Apple.

Each machine comes with a nifty ticker-tape front-panel LED display called a Smart-Vue, which pinpoints errors and keeps you posted about what's happening inside better than any other tool we've seen.

And, while every non-IBM keyboard is an insult to your fingers, PC's Limited gives you one that is less irritating than most and lets you flip a switch on the bottom to customize the location of the Esc key—a nice touch. Plus, you can order the system in two chassis footprints, a large one that lets you cram hard disks under the hood and a petite one that doesn't take up your whole desk.

Use this screamer just once and you'll be hooked. It's almost enough to wean me from my crawling 8-MHz IBM.**—Paul Somerson**

**FACT FILE: PC's Limited 286/16;** PC's Limited, 1611 Headway Circle, Bldg. 3, Austin, TX 78754 (800) 426-5150, (512) 339-6800 **List Price:** $2,995 with 1 Mbyte RAM, single 1.2-Mbyte floppy disk drive, eight expansion slots, 200-watt power supply, configurable PC AT–style keyboard. **Reviewed:** Volume 5 Number 16, page 33 CIRCLE 677 ON READER SERVICE CARD

## Microsoft Word, Version 3.1

"It just keeps getting better and better" was once the slogan for the legendary Jaguar automobiles. As far as I'm concerned, Microsoft Corp. should adopt it for *Word*, which has become a legendary PC word processor.

*Microsoft Word* has always been a power user's product. *Word*, Version 3.0—and, more recently, Version 3.1—enhances that tradition. The latest editions contain enough useful new

features to convince any user of a previous version to upgrade, and to convert even the most devoted *WordStar* user.

For example, any serious writer will appreciate the first-rate outline processor built into *Word* (even M. David Stone, my favorite outline hater and *WordStar* lover, switched to *Word* 3.0 to take advantage of this new feature). And PC users who regularly produce large documents will bask in the power of *Word*'s index and table of contents generators and its excellent document assembly features. I keep finding new applications for *Word*'s flexible implementation of hidden text.

*Word* 3.1 is delivered complete with a built-in version of Writing Consultants' *Word Finder* thesaurus. Not only is *Word Finder* more convenient than in its native RAM-resident version, but the built-in edition seems to operate far more quickly—and besides, the built-in edition fully supports *Word*'s elegant EGA-compatible graphics interface.

Even with new features tacked on, *Word* maintains the consistency of structure and style that has distin-

Illustrations: Robert Pizzo

guished Microsoft's best applications from its competitors' wares since its birth. Once you catch on to *Word*'s unique lingo (inherited from the typesetting industry) and get the hang of the Microsoft command menu interface (the same one Microsoft uses for *Access* and *Multiplan*), you won't get lost even as you explore the deepest corners of *Word*.

And just in case you do lose your way, Microsoft has redefined "context-sensitive help" to include "context-sensitive tutorials." You're never more than a couple of keystrokes away from screens full of excellent teaching material.

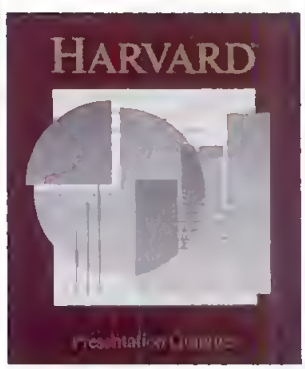
It just keeps getting better and better.—**John Dickinson**

**FACT FILE:** ***Microsaft Word*, Version 3.1;** Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073 (800) 426-9400, (206) 882-8080 **List Price:** $450 **Requires:** 256K RAM, two disk drives or a hard disk, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 21 CIRCLE 694 ON READER SERVICE CARD

## Harvard Presentation Graphics

OK, so you can't fiddle with every last detail. And PC graphics junkies may turn up their noses, and go off to the bigger, more-expensive, harder-to-use programs that let them move obscure labels on stacked-bar charts into weird places.

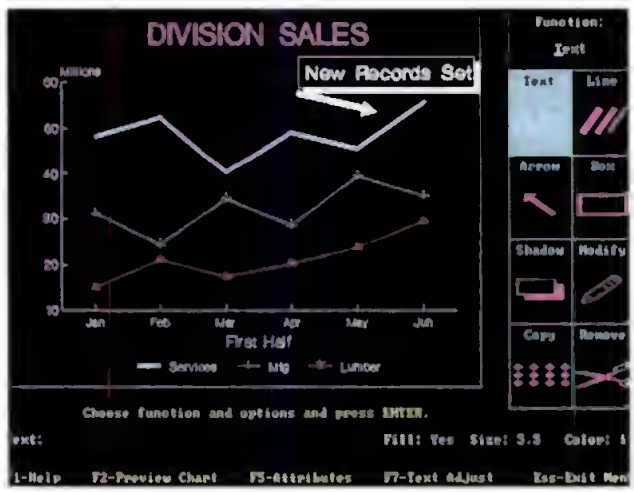
For the rest of us—about 90 percent of PC-based business graphics users, I'd guess—*Harvard Presentation Graphics (HPG)* from Software Publishing Corp. is a godsend. We want quick, good-looking charts and graphs, not a Meaningful Encounter, when we sit down to knock out a few slides or overheads. And, truth to tell, *HPG* has such well-designed templates and standard formats for charts that we'd usually produce poorer results if it let us push things around willy-nilly.




And best of all, *HPG*'s results look good on paper. Even from simple Epson printers, its output is impressive. It looks almost typeset, and in "real" typefaces like Helvetica, at that.

Learning to produce handsome graphs and bullet charts ("word charts") with *HPG* takes maybe 30 minutes. And because the program manages the details of the graphics so well, you'll find you spend minutes, not hours, using it, because you're not tempted to fiddle endlessly with the details.

Last year's hot PC-graphics product was *Freelance*, a freeform-drawing package that's almost as much fun to use as a video game. *HPG* isn't exactly fun to use—unless you're tickled by stacked bars and exploding pies—but it produces better-looking business graphs faster and easier than any other program I've seen.—**Jim Seymour**




Harvard Presentation Graphics *creates speedy charts of almost typeset quality.*

**FACT FILE:** ***Harvard Presentation Graphics;*** Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039 (415) 962-8910 **List Price:** $395 **Requires:** 256K RAM, a graphics card. Not copy protected. **Reviewed:** Volume 5 Number 22 CIRCLE 688 ON READER SERVICE CARD

## R :base System V

Instead of resting on its laurels, Microrim kept those features that made *R:base Series 5000* popular, expanded them, added a few new ones, rewrote the code, and released *R:base System V*.

Until *R:base System V*'s introduction, you either made do with a flat-file manager or hired a consultant to program your relational database management system. Now virtually anyone can create, manipulate, and program a relational database with a minimum of fuss. *System V*'s code generation modules and prompt-by-example (PBE) mode have smoothed the learning curve into a molehill.

*System V* is a true relational database with more features than an IBM EGA card has chips. In addition to a searchable note field, a cross-tabulation command, and a pleth-

ora of functions for mathematical, statistical, and string operations, *System V* allows you to define one-to-many and many-to-one relationships. Its PBE mode offers a smooth and painless transition into the program's features and procedural language. And its Express modules permit you to create or change a database or form, build or alter an application, and design a menu without having explicitly learned any of *R:base*'s commands.

*System V* has set a new standard for programmable databases. *dBASE* may have a bigger installed base, but *System V* will be the choice for the user who doesn't want to hire a consultant for every customized application.

**—Vincent Puglia**

**FACT FILE:** ***R:base System V;*** Microrim, P.O. Box 97022, Redmond, WA 98073 (206) 885-2000 **List Price:** $700; upgrade for *R:base Series 5000* owners, $99. **Requires:** 512K RAM, hard disk, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 18, page 33 CIRCLE 679 ON READER SERVICE CARD

## Toshiba T1100 Plus

The Toshiba T1100 Plus, from Toshiba America, has all the earmarks of a great laptop computer. Its sterling qualities include dual 720K-byte floppy disk drives, 640K RAM, a fast 80C86, a great keyboard, a readable screen that is truly adjustable, and an optional Hayes-compatible 1,200-bit-per-second modem. It runs for up to 8 hours on a charge and weighs in at under 10 pounds. The Toshiba T1100 Plus can even sit comfortably on your lap without dislocating your knee or leaving an indentation in your stomach.

Toshiba T1100 Plus

The design time lavished on the Toshiba T1100 Plus shows up in the sculpted lines of its plastic shell and its logical keyboard layout. It travels well across town or across the country. Wait no longer if you need a computer that goes where you go: the Toshiba T1100 Plus is it.

**—William G. Wong**

**FACT FILE: Toshiba T1100 Plus;** Toshiba America Inc., Information Systems Div., 2522 Chambers Rd., #210, Tustin, CA 92680 (800) 457-7777, (714) 730-5000 **List Price:** With 256K RAM, $1,999; with 640K RAM, $2,399. **Reviewed:** Volume 5 Number 22 CIRCLE 690 ON READER SERVICE CARD

## Toshiba T3100

Look, if you like PCs and you don't go a little weak in the knees when you see Toshiba America's stylish, powerful lap machine, the T3100, see your doctor. You've got tired blood.

The T3100 is an AT in a 15-pound flat box you can throw into your attaché case.

Let's get the bad stuff out of the way first: it won't run on batteries and it costs almost 5 Gs. If neither of those facts turns you off, it's good news from here on in: an 8-MHz 80286 processor, built-in 10-megabyte hard disk and 720K-byte IBM PC Convertible–compatible microfloppy, a superb high-resolution gas plasma screen, good to better-than-good keyboard, and a high level of PC compatibility. And an optional ($295) 1,200-bit-per-second internal modem (yes, Virginia, it's Hayes compatible) that's definitely the most line-noise-resistant one I have ever used.

The T3100's hard disk is the slowest ever crafted by man, but it locks the heads up out of harm's way every few seconds. So slow disk-access speed may be a fair trade-off for not having to remember to run a head-park drill every time you want to pick it up and go.

And go you will. If my T3100 had its own frequent-flyer card, it'd have earned a half-dozen free trips. At 60,000 miles and counting, it's taken on baggage handlers, cabbies, inquisitive hotel maids, hot car trunks, and cold beer splashes. Without a hiccup.

I wish it were about 5 pounds lighter. I wish more graphics programs had screen drivers for its wiry sharp 600 by 400 graphics mode, so it didn't have to (automatically) fall back into its CGA emulation for graphics. And I wish the hard disk was bigger and faster. But as it sits, the T3100 ties with Compaq's Deskpro 386 for the most interesting hardware of the

Toshiba T3100

# Our Latest Business Reply.

At WordPerfect Corporation, the one thing we do best is listen. When users asked for a powerful word processor, we listened—and gave them WordPerfect. When they told us how we could make it better, we listened—and came back with a better WordPerfect.

Lately, we've been hearing from a lot of corporate WordPerfect users, and we've been listening. The result is WordPerfect 4.2.

**Better business.**

WordPerfect 4.2 incorporates several new features into WordPerfect word processing to make life in the business world easier.

Statistical typing lets you easily integrate figures and tables into your WordPerfect documents. And you can include comments which are displayed on screen but not printed out.

Document preview allows you to view your finished document—showing justification, headers and footers, footnotes, etc.—before you print. And a document summary can be created and saved to record a document description, creation date, author and typist.

**Legal aid.**

Some of the new business features in WordPerfect 4.2 are specifically designed for easier handling of legal documents. References within a document can now be marked to allow automatic generation of a table of authorities. And line numbers can be designated and printed in the left margin.

Other new features include an on-line tutorial for easy learning, an expanded thesaurus with over 10,000 headwords, concordance capability, non-sequential page printing, and a new Post Script printer driver that supports all of WordPerfect's current capabilities.

**Made to order.**

Give your business the benefit of a word processor that responds to corporate needs. Get WordPerfect 4.2—the perfect tool for better business.

For more information, call or write WordPerfect Corporation, 288 West Center St., Orem, Utah 84057 (801) 227-4000.

WordPerfect CORPORATION

CIRCLE 513 ON READER SERVICE CARD

year. I'd call that a very, very good year.—**Jim Seymour**

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**FACT FILE: Toshiba T3100;** Toshiba America Inc., Information Systems Div., 2441 Michelle Dr., Tustin, CA 92680 (714) 730-5000 **List Price:** $4,499 with 640K RAM, 10-Mbyte hard disk, 3½-inch 720K disk drive; internal 300/1,200-bps modem, $399; external 5 ¼-inch disk drive, $499; expansion chassis with five slots, $999; 15-key numeric keypad, $99; 2-Mbyte extended memory RAM card, price to be determined; PC Floppy Link, $199; expansion interface card, $199. **Reviewed:** Volume 5 Number 22 CIRCLE 585 ON READER SERVICE CARD

## PFS:First Choice

*PFS:First Choice* is the best choice for first-time PC users. This simple integrated package borrowed its components from Software Publishing Corp.'s extremely successful

*PFS:* series—*PFS:Write, File, Report,* and *Access.*

*PFS:First Choice*, with a context-sensitive help facility, was designed for novices. The word processor can handle up to a 32K-byte document and features an 80,000-word spelling checker. The communications section has six services predefined and the ability to create automatic log-ons. The database is no *dBASE III Plus*, but it's not bad. You can store about 16,000 records on a 10-megabyte hard disk or around 2,800 on a 360K-byte floppy disk. No indexing is available, but you can sort on as many fields as you want. Report printing is a piece of cake, and you can create customized reports with little or

no previous database training. The spreadsheet is the weakest module; it's adequate but not very powerful.

Beginners will appreciate *First Choice*'s simplicity, *PFS:* series fans will love the integration, and even experienced users will find something of value.

—**Christopher Barr**

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**FACT FILE:** ***PFS:First Choice;*** Software Publishing Corp., P.O. Box 7210, 1901 Landings Dr., Mountain View, CA 94039-7210 (415) 962-8910 **List Price:** $199 **Requires:** 256K RAM, mouse optional, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 17, page 33 CIRCLE 576 ON READER SERVICE CARD

## Webster's New World On-Line Thesaurus and Webster's New Word Writer

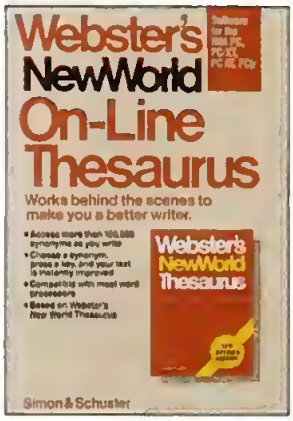
I'm seldom at a loss for words, but when I am, help is a blessed keystroke away thanks to *Webster's New World On-Line Thesaurus* from Simon & Schuster. When I find myself grasping for an elusive expression or plagued by the ravages of writer's block, I press the "hot key" and begin my pop-up quest for the perfect word.

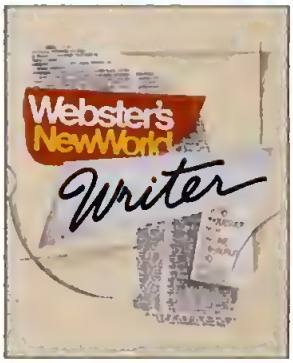
Not only does this RAM-resident thesaurus furnish a bevy of choices, but it looks just like—and works more efficiently than—a paperback thesaurus.

Physically, the program's display resembles its hard-copy counterpart, replete with a lexicon that includes parts of speech, numbered entries, and a comprehensive related-words cross-referencing system. You move the cursor through the word list and press a "substitution" key, and the chosen word is instantly substituted in your text. As an extra added attraction, *Webster's New World On-Line Thesaurus* not only replaces the word but also makes sure it is grammatically and syntactically correct, using its surprisingly accurate prefix- and suffix-matching capabilities. Article agreement and capitalization are automatically preserved.

Because it is instantaneous and easy to use, *Webster's New World On-Line Thesaurus* encourages you to explore the language. I can mosey from cross reference to cross reference while the program tracks my path. I can keep notes on my favorite contenders. I can electronically forge my way through myriad synonyms in less time than it takes me to unearth my copy of *Roget's* from the stack on my desk. *Webster's* even offers choices for such oddities as *point of view, cramp one's style,* and *confidence man.*

I've sworn off most RAM-resident programs because of their belligerence, but I'm addicted to *Webster's New World On-Line Thesaurus.* It's easy to install, it works with almost all word processors, and it's intuitive. The accompanying reference manual contains 75 pages of priceless style and usage pointers that should be taken to heart. A serious tool for anyone who cares about words, *Webster's New World*




*On-Line Thesaurus* deserves serious praise.

Also, if you are interested in a complete writing tool, consider *Webster's New World Writer.* The program is truly easy to learn and eminently affordable, and it includes just about every feature the "big leaguers" include. For $150 you get a sophisticated word processor, a great thesaurus, and a speller that's been *PC Magazine*'s

# Now, Tallgrass takes your PC's places they've never been before.

## Introducing LanCourier.™ The virtual network server.

Every company that's grown to depend on personal computers knows about growing pains. Accounting is on Ethernet.™ Manufacturing's on ARCNET.™ R & D is off site. Marketing wants IBM Token Ring.™ And everybody needs access to the mainframe.

Until now, none of them could tap the full power of your computer resources.

Now there's LanCourier, the virtual network server from Tallgrass. It's a fully integrated file and communications server that gives each of your PCs access to all your company's resources.

LanCourier uses UNIX V™ with the powerful 68000 processor to perform file server, print sharing and communications functions, while supporting DOS applications running on the network. With up to 5 megabytes of RAM and 240 megabytes of built-in disk storage expandable through a SCSI port, LanCourier gives you fast access to a multitude of resources.

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**Nominated for the 1986 PC Magazine Award for Technical Excellence.**

**CIRCLE 215 ON READER SERVICE CARD**

# STB's Chauffeur HT will drive your Lotus where Hercules can't go.

## Get full Hercules compatibility and the first 1056 x 352 resolution.

With STB's Chauffeur HT,™ you can run software compatible with the Hercules Graphics Card™ on any IBM® compatible computer.

You get stunning monochrome graphics and high resolution text.

How does that make your life easier? Simple.

When you run a Lotus™ spreadsheet (release 2), you can view up to 65% more data on the screen at one time. All 12 months plus the totals column, in full 10 character columns!

If you use Hercules or IBM adapters, you have to pan to see that much data, wasting keystrokes and valuable time. But that's just the beginning.

When you use Microsoft Windows™ with the Chauffeur HT, you can display one application on the first two thirds of the screen, leaving the other one third for additional applications.

That's how Windows was intended to work.

Whether you want to get more mileage out of your Lotus or open more windows in monochrome graphics, only one video adapter goes the distance. The Chauffeur HT.

Contact your local dealer and ask for STB's Chauffeur HT, or any of STB's full line of video, memory and I/O boards.

*Simply The Best*

STB Systems, Inc.

1651 N. Glenville, Suite 210, Richardson, Texas 75081

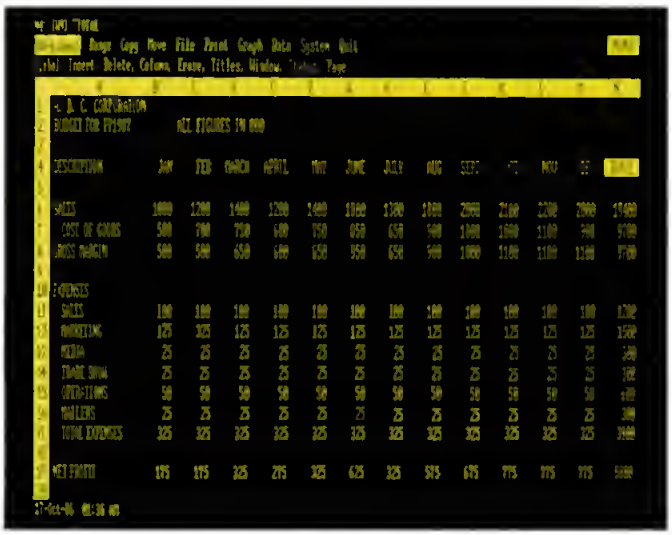
**CIRCLE 517 ON READER SERVICE CARD**

**Full Hercules Compatibility.**
- Runs Hercules Graphics Card software

**132 Character Display.**
- Perfect for Lotus 1-2-3™
- View 65% more data on screen than Hercules or IBM
- 8 x 14 character cell (over twice the character resolution previously available on any 132 character mode)

**High Resolution Monochrome Graphics.**
- 1056 x 352 bit mapped graphics, compared to 720 x 348 for Hercules
- 46% more than Hercules Graphics Card

**More Space for Windows.**
- 1056 x 352 bit mapped resolution
- Almost 50% more than Hercules Graphics Card



**ACTUAL SCREEN showing all 12 months and the totals column of a Lotus spreadsheet *at one time.* Note the sharpness of the 8 x 14 character cell produced by STB's Chauffeur HT.**

**Terminal Emulation.**
- First high resolution 132 character display
- Display full reports on screen
- Crisp 8 x 14 character cell

**Drivers for Lotus 1-2-3 (release 2), Microsoft Windows, and Symphony.™**

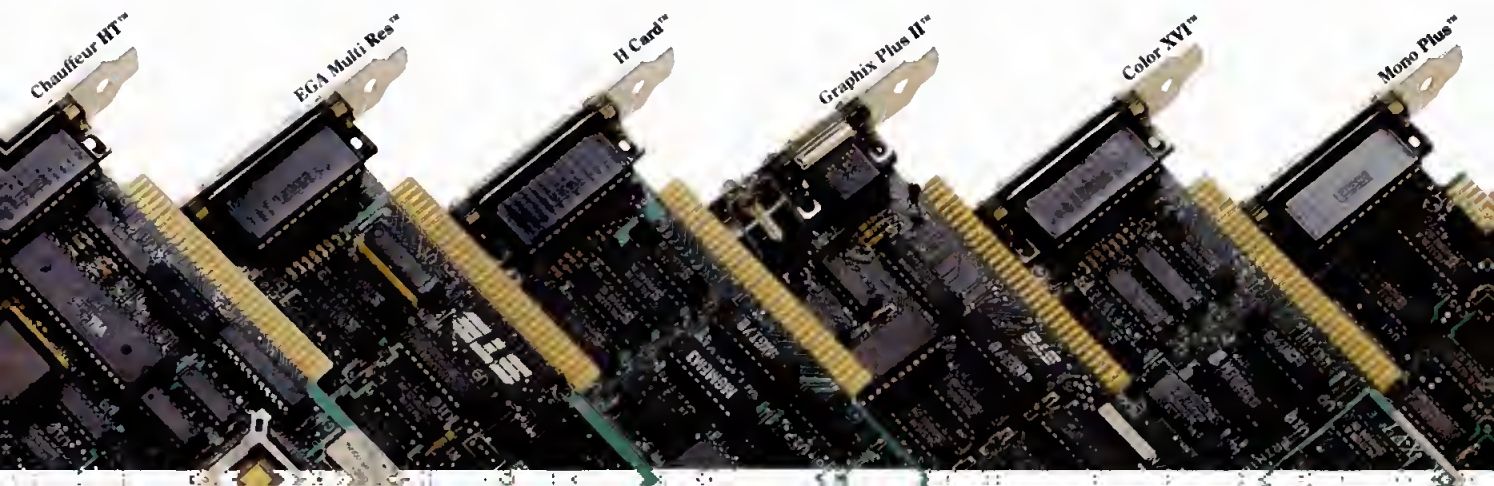
**Full I/O Capabilities.**
- Standard parallel printer port
- Optional clock/calendar
- Optional serial port

**PC Accelerator™ Software.**

**STB Two-Year Warranty.**

**IBM PC/XT/AT Compatible.**

*STB, Chauffeur HT are trademarks of STB Systems, Inc. IBM registered trademark of International Business Machines Corp. Hercules and Hercules Graphics Card registered trademarks of Hercules Computer Technology. PC Accelerator trademark of RESICORP. Lotus, Lotus 1-2-3, Symphony trademarks of Lotus Development Corp. Microsoft trademark of Microsoft Corporation.*



Editor's Choice ever since the program hit the market. Included in the four-disk, handsomely bound package is a writer's guide to help you get the most mileage from word processing. If you're shopping for a New Year's writing tool that won't take you until 1988 to master, look no further!—**Robin Raskin**

**FACT FILE:** ***Webster's New World On-Line Thesaurus;*** Simon & Schuster, Gulf+Western Bldg., One Gulf + Western Plaza, New York, NY 10023 (800) 624-0023 **List Price:** $69.95 **Requires:** 12K RAM, DOS 2.0 or later. **Reviewed:** Volume 5 Number 12, page 42 CIRCLE 675 ON READER SERVICE CARD

**FACT FILE:** ***Webster's New World Writer,*** Simon & Schuster, Gulf + Western Bldg., One Gulf + Western Plaza **List Price:** $150 **Requires:** 256K RAM, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 16, page 36 CIRCLE 674 ON READER SERVICE CARD

## Zenith Z-181 Portable PC and Diconix 150

For years people have been shoving dark, gloomy, blotchy LCD screens in front of my face, saying, "Look how wonderful this laptop is!" These are the same rubes who profess to see faint biblical images in old cloth, pictures scratched by interstellar aliens into the Sonora desert, and messages from Babylonian explorers chiseled on rocks off Nova Scotia. Give me a big break.

"I like the Tandy's formfactor," they sputter, "and the handle on the Toshiba. And the keyboard on the IBM Convertible has just the right feel." OK, maybe. But they're *all unreadable*. Until now.

Zenith Data Systems' awesome Z-181 Portable PC is the first really usable laptop. Its shocking-blue supertwist LCD screen, nearly as big and bright as a CRT, and with the properly proportioned image area, puts all the other sorry, dim, green, and gray excuses for portable displays to shame. The keyboard isn't perfect, but it's miles above the rest. OK, it could use a handle, and Zenith could shave off a pound or two and goose up the performance with a fast 286, but the screen makes you forget all that. Images look as if they're painted on.

If you like reading in the dark and typing on marshmallows, the other squinty, murky boxes may do. But if you need a road PC you can really use, don't even consider anything other than the Zenith Z-181.

And while you're at it, round out your traveling system by slipping a Diconix 150 ink jet printer, from Diconix, into your luggage. This tiny battery-powered gem, sold by a Kodak subsidiary, tips the scales at under 4 pounds, is only slightly (and I mean slightly) larger than a detective novel, and performs like a machine 20 times its size.

The Diconix 150 is Epson FX/IBM Proprinter compatible, dispatches 8½- by 11-inch sheets without a hitch, prints in five creditable modes (plus low- and high-resolution graphics), handles tractor-feed forms, envelopes, and even transparencies, puts all the important controls on a svelte front panel, and boasts one of the rarest features I've ever seen: a slim, intelligent, well-organized, fact-packed manual.

If you need a complete PC system away from the office, you can't go wrong with the Zenith Z-181 and the Diconix 150, a marriage made in computer heaven.

—**Paul Somerson**

Diconix 150

Zenith Z-181 Portable PC

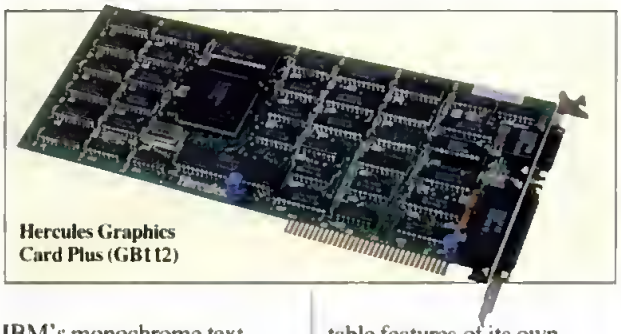
**FACT FILE: Zenith Z-181 Portable PC;** Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025 (800) 842-9000 **List Price:** $2,399 with 640K RAM, two 3½-inch 720K disk drives, parallel/serial ports, RGB output, power supply/battery recharger, external drive connector, firmware diagnostics, and debugger; internal modem (300/1,200 bps), $399. **Reviewed:** Volume 5 Number 22 CIRCLE 656 ON READER SERVICE CARD

**FACT FILE: Diconix 150;** Diconix Inc., 3100 Research Blvd., P.O. Box 3100, Dayton, OH 45420 (513) 259-3100 **List Price:** $479 **Reviewed:** Volume 5 Number 9 CIRCLE 668 ON READER SERVICE CARD

## Hercules Graphics Card Plus (GB112)

The Graphics Card Plus (GB112) from Hercules Computer Technology is not a product for the future; it's a product for right now. Specifically, it's for *1-2-3, Symphony,* and *Microsoft Word* users who want the speed of character-based video with the advantages (on-screen fonts and graph displays) of a graphics board.

The Hercules Graphics Card Plus is fully compatible with the classic Hercules Graphics Card, originally introduced in 1982. By adding a 720 by 348 graphics mode to



Hercules Graphics Card Plus (GBtt2)

IBM's monochrome text mode, the original Herc card became the only non-IBM video board to achieve widespread software support and become a PC standard.

The Herc Plus card adds a third video mode, called RamFont. On-board memory for 12 downloadable fonts allows the Herc Plus to display all *Microsoft Word*'s on-screen formatting while still working in character mode. The Herc Plus also comes with *1-2-3* and *Symphony* drivers that do a 90 by 38 character-mode display and can superimpose a graph in a corner of the spreadsheet.

The price is great, and the manual includes full technical documentation.

**—Charles Petzold**

**FACT FILE: Hercules Graphics Card Plus (GBtt2);** Hercules Computer Technology, 2550 Ninth St., #210, Berkeley, CA 94710 (415) 540-6000 **List Price:** $299 **Requires:** IBM Monochrome Display or compatible. **Reviewed:** Volume 5 Number 14, page 51 CIRCLE 670 ON READER SERVICE CARD

## SuperCalc4

If market dominance were based on rational criteria, Computer Associates' *SuperCalc 4* would certainly replace *1-2-3* as the leading spreadsheet program. After all, it can do anything that *1-2-3* can do and adds some notable features of its own.

Some of these extras are carryovers from earlier versions of *SuperCalc*. For instance, it is not copy protected; so you don't have to worry about key disks, trashed hard disks, and copy-

unlocking schemes. And its graphics are not only better-looking than *1-2-3*'s, but more tightly integrated as well, so that they don't require a separate module. The new version's enhancements include a learn feature that lets you create macros by recording your keystrokes.

*SuperCalc4* also includes several features adopted from *1-2-3*. Most notably, it replaces the single-letter menus of *SuperCalc3* slash commands with Lotus-like full-word menus. At the same time, it keeps *SuperCalc3*'s shorter, more logical menu structure. In short, *SuperCalc4* has combined the best features of *SuperCalc3* and *1-2-3*.

If you need to exchange files with *1-2-3* users, you'll be impressed by *SuperCalc*'s new import-and-export scheme. It converts files to and from *1-2-3*, (Release 1A or Release 2) format, with little or no need to massage the template after the translation. For me, this ability to exchange files with *1-2-3* undermines the one good argument for bypassing *SuperCalc*.

**—M. David Stone**

**FACT FILE: *SuperCalc 4;*** Computer Associates, 2195 Fortune Dr., San Jose, CA 95131 (408) 942-1727 **List Price:** $495; upgrade from Version 3, Release 2.1, $20; Version 3, Release 2.0, $100. **Requires:** 256K RAM, two disk drives, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 15, page 33 CIRCLE 691 ON READER SERVICE CARD

## TOPS Network

What's a Macintosh product doing in *PC Magazine*? TOPS is a network program that manages the Appletalk network in an intelligent, distributed fashion: giving any computer on the net access to any files published by any other computer on the net.

When Centram Systems West says any computer, it includes IBM PCs and compatibles.

To get PCs and Macintoshes to coexist peacefully in a network environment developed for Macintoshes alone, Centram had to go to extraordinary lengths, essentially figuring out how to get DOS to recognize and deal with Macintosh filenames and structures as its own (and vice versa). What it achieved is a system that can

# Peachtree's® Complete Business Accounting System.

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# MANUFACTURERS' 1986 EFFORTS: CHEERS AND HISSES

What an interesting year this has been in the PC business. New machines, new software, new approaches, mixed in with some lingering problems, old ideas, and very old attitudes from a few companies that haven't yet caught on that this isn't a hacker's game anymore.

**KUDOS TO . . .**
Peachtree, which woke up one morning and decided that its eight integrated accounting-software modules, which the day before had sold for $600 each, were, at $4,800 for the set, just a tad overpriced and so cut the price for the whole set down to $199—a pretty good discount in anyone's league.

Ashton-Tate, Javelin, Ansa, Software Publishing, Microsoft and all the other vendors who decided to show they trust their customers by removing copy protection from their products.

Symantec, which spontaneously sent everyone who bought the first version of *Q&A* a free upgrade that included a spelling checker and better printer support.

Compaq, for the courage to plow ahead with an 80386 machine in the face of *nothing* from IBM.

Chips & Technologies, Paradise Systems, Video-7, Vadem, and Phoenix, whose relentless focus on improving the breed through better and fewer chips shames the billion-dollar giants with R&D budgets tens to hundreds of times these midgets' combined annual revenues.

The American Federation of Information Processing Societies (AFIPS) and the Interface Group, for having the wisdom and courage to kill off, respectively, the reigning co-runners-up among brain-dead trade shows, the Office Automation Conference and the Winter Comdex (held at the height of winter, of course—April—in frosty Los Angeles).

**BRICKBATS TO . . .**
All these software companies that apparently decided the answer to overloaded customer-support phone lines was "Let 'em ring!"—despite the marketplace's clear response that it's OK to charge for support, as long as that support is *good*.

IBM Corp., for introducing the PC Convertible in

transparently move both data files and applications from PC-DOS to the Macintosh and back. The first time you open a *1-2-3* file on an IBM PC with *Excel* on a Macintosh, you simply won't believe your eyes. When you launch *WordStar* on your Compaq from an Apple hard disk, you'll want to look under the desk for the real hard disk.

In a world in which promises of compatibility and coexistence are mostly talk, Centram's ability to translate system protocols on the fly is an example of the best kind of problem solving. Best of all, the drivers and the utilities included with Centram's Appletalk board and software package for the PC actually constitute one of the easiest PC-only networks on the market to install, learn, and maintain. Even if you're unalterably opposed to having cute little Macintoshes invading your turf, you can still benefit from Centram's work.—**Stewart Alsop**

**FACT FILE: TOPS Network;** Centram Systems West Inc., 2372 Ellsworth Ave., Berkeley, CA 94704 (415) 644-8244 **List Price:** $389 CIRCLE 665 ON READER SERVICE CARD

## What'sBest!

And all along you thought the gritty question was, "What if . . . ?"

But it doesn't take very many worksheets to discover that "What if?" is really just an interim step, en route to "What's *best*?" And then you discover the horrors of lincar programming. Because with enough variables in a spreadsheet to make it useful, you've got to solve so many simultaneous equations to optimize results that LP is the only way.

But LP is a might big leap from @sum(c14..c92).

Enter General Optimization's *What'sBest!*, a kind of "linear-programming power-to-the-people" tool from Sam Savage and the math gurus at the University of Chicago. Build a tidy little *1-2-3* spreadsheet, identify just what *best* means in your case, tell the program which variables it can fiddle with, and sit back. Or go for a cup of coffee, or lunch, or an afternoon in the park maybe.

*What'sBest!* will swap itself and *1-2-3* in and out of

memory and start number-crunching its way toward a thoroughly optimized result. That will take a while—a long while if you've got a complex problem, with a couple of hundred variables, a very long while if you haven't got a math coprocessor chip—but the results are worth it.

*What'sBest!* is a very smart product in a lot of ways, but nowhere are its smarts so evident as in the use of *1-2-3* to construct the parameters of the problem. A familiar interface, the ability to run mind-numbing calculations, no copy protection, product pricing by maximum problem size, and the certainty that you've worked out the best answer—not merely a good enough one. What more could you ask?
**—Jim Seymour**

**FACT FILE: *What'sBest!*;** General Optimization Inc., 2251 N. Geneva Terr., Chicago, IL 60614 (312) 248-

April with a modem that didn't follow the Hayes command set—and not delivering even that modem till September. For a laptop PC, a fast, compatible modem is about as important as a good, legible screen, which, come to think of it, isn't so hot on the Convertible, either. R.I.P.

Autodesk, which chose to hobble the fine new release of *AutoCAD* with clumsy hardware-based copy protection in the form of a gizmo that plugs into the PC's parallel port.

IBM, for introducing the RT PC with (choose one) half the power or twice the price users wanted. IBM also earns a special Chutzpah Oak Leaf Cluster for pricing its UNIXoid operating system at $3,400.

Hewlett-Packard Co., which, having created the low-end desktop laser printer market, then made what Steve Jobs accurately called a "brain-damaged" decision to turn away from the emerging industry-standard page-description language, PostScript, in favor of an obscure alternative.

IBM, for selling a 1) crummy, 2) pricey, 3) composite, 4) Apple IIc–refugee monitor to both those people who use PC Convertibles at their desks.

Lotus, for taking a half-step toward removing copy protection by announcing that large customers whose antipiracy steps Lotus approved could get a disk that would strip copy protection from Lotus's products. Trouble is, half-steps toward treating customers decently are like approaching infinity halfway at a time: you never get there.

The FCC, which, having acted responsibly by moving on vendors whose PC products violated RF/EMI standards, then made a second good decision to move testing in-house—but didn't staff-up to handle the work, throttling the release of new PCs at an important moment for vendors and users alike.

The American Federation of Information Processing Societies (AFIPS), for lacking the wisdom and the courage to profoundly recast or finally inter NCC, the all-time world-class brain-dead trade show.—**Jim Seymour**

*Jim Seymour is a contributing editor of* PC Magazine.

7300 **List Price:** Professional (640K), $995; commerical (384K), $695; personal (256K), $149. **Requires:** 640K, 384K, or 256K RAM; two disk drives; *Symphony*, Version 1, or any version of *1-2-3*; DOS 2.0 or later. **Reviewed:** Volume 5 Number 13, page 36. Not copy protected. CIRCLE 655 ON READER SERVICE CARD

## AskSAM

Seaside Software's *AskSAM* is the kind of program that makes you want to shout, "What took them so long?" Not only does it make creating and maintaining a text-oricnted database a joy, but its elegance, ease of use, and seemingly instantaneous retrieval times will compel you to find new applications for it.

Unlike traditional databases, *AskSAM* lets you enter data anywhere within any record. Because there are no mandatory fields, records can be of any length and can consist of any type of information: company names and phone numbers, inventory lists, product features, software hints and techniques, proposals, and reminders. If you want, you can impose structure through the use of explicit labels. You end up creating a database much as you would on paper, with the following major differences: you can locate anything within seconds or minutes; you can create and save reports that perform simple arithmetical and statistical operations; and you can do without the hundreds of paper scraps that would otherwise clutter your workplace.

*AskSAM* is not only the easiest, most flexible text-based database program on the market today, it is one of the most versatile databases, period.—**Vincent Puglia**

**FACT FILE:** *AskSAM*; Seaside Software, P.O. Box 31, 119 S. Washington St., Perry, FL 32347 (800) 327-5726, (904) 584-6590 **List Price:** Version 2, $150; Version 3, $200. **Requires:** 128K RAM (Version 2), 256K RAM (Version 3); one disk drive; DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 20 CIRCLE 678 ON READER SERVICE CARD

## C.IE LIPS 10

Lots of laser printers offer speed, flexibility in the form of emulation, and outstanding print quality. Most come with thick programming manuals, lengthy escape code sequences, or arcane front-panel codes that make chang-

ing default settings about as intuitive as cuneiform on a Sumerian tablet. Of all the lasers I saw during *PC Magazine*'s recent printer issue, only the CIE LIPS 10, from CIE Terminals, had a front-panel display that made operating the printer as easy as running a photocopier.

Designed around a Konica engine and an Oasys controller board, the LIPS 10 is factory-rated at 10 pages per minute. It emulates the Epson FX-80, the Diablo 630, and the Hewlett-Packard Laserjet. And it produces some of the sharpest output this side of a Mergenthaler. Its programming language allows you to manipulate a set of vector-based fonts and to generate new typefaces simply by specifying a few parameters, such as pitch, *x*- and *y*-axis bolding, and degree of slant.

The printer's greatest innovation, though, is its front display panel. Where most laser printers require you to learn two- or three-character codes, the LIPS 10 comes with an LCD screen that displays the default settings in everyday English. There's no need to refer back to the manual, no more instances of finding your left margin set to 67 because you thought C30 was the appropriate code, and no need to write batch files for every possible configuration. Instead, you scroll through the settings until you locate the one you need and then enter the new value.

The LIPS 10 may not have Adobe Systems' PostScript. it may not currently support HP's soft fonts, but with its vector-based fonts and friendly front panel, it may not need to. The LIPS 10 is the friendliest and most flexible laser printer on the market today.—**Vincent Puglia**

CIE LIPS 10

**FACT FILE: CIE LIPS 10;** CIE Terminals, 2505 McCabe Way, Irvine, CA 92714-0315 (800) 854-3322, (714) 660-1421 in Calif. **List Price:** $3,495; starter kit (includes cassette, manuals, drum, toner), $299. **Reviewed:** Volume 5 Number 19 CIRCLE 681 ON READER SERVICE CARD

## A T-Style Keyboard

It took IBM Corp. almost 5 years from the introduction of the PC to build a real keyboard that separates the cursor controls and the numeric keypad. It's a small step, but a welcome one nonetheless.

AT-Style Keyboard

Not everyone is thrilled to see the function keys arrayed across the top rather than in two columns on the left side, but we'll get used to that. Not so welcome is IBM's bad habit of moving the Ctrl, Alt, Esc, and CapsLock keys around with each new incarnation of its keyboard. The effect is rather like what the Pentagon tried to do in the 1970s by putting ICBMs on railroad flatcars and shuttling them around the country so the Russians would never know where they were.
—**Bill Howard**

## Show Partner

Presentation graphics can make the personal computer the center of attention in meetings and conferences. New software developed in the last year has changed the PC from a graphics preparation system to a full-blown display unit capable of showing video slides and even limited animation.

The price-performance leader in real-time presentation software is clearly Brightbill-Roberts/The Marketing Channel's *Show Partner*. This clever package of four programs has brought the cost of a presentation system to a new low while providing very high on-screen quality that includes both CGA and EGA compatibility. In fact, the package has proven so popular and powerful that it's now included with several display systems and even bundled with the Microsoft Mouse.

*Show Partner* is a quick and easy means of creating computerized presentations.

> *Show Partner* is a quick and easy means of creating computerized presentations. You can clip images and animation routines from the library included with the package.

# The Diconix 150. So small, it's the one PC printer you can take lightly. Anywhere.

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This program captures screens made by other programs and lets you edit them or draw your own. If you don't have an artistic bent, you can simply clip images and short animation routines from the modest library included with the *Show Partner* package or from the larger libraries that are available from outside suppliers.

Once you've got all your images, you can arrange their presentation order any way you want, flipping, flopping, dissolving, wiping, and blasting between them. To add sound, a synchronized digital voice and music recording system is also available to complement your on-screen video blitz.

Most of the *Show Partner* programs are built around the same easy-to-use, pull-down menu interface. The software is compact, and it generates compact data files of your on-screen images. For extra convenience, a special run-time module is included so that you can distribute your finished presentations and make them run without paying a royalty to a software publisher.—**Winn L. Rosch**

**FACT FILE:** ***Show Partner*****, Version 1.2;** Brightbill-Roberts/The Marketing Channel & Co. Ltd., 120 E. Washington St., #421, Syracuse, NY 13202 (315) 474-3400 **List Price:** $149; $30 for *GraFIX Partner* owners. **Requires:** Show Partner Animator, 256K RAM; Editor, 100K RAM; 320K RAM with CGA, 640K RAM with EGA; two disk drives. Not copy protected. **Reviewed:** Volume 5 Number 22 CIRCLE 689 ON READER SERVICE CARD

## MS Kiss

Nineteen eighty-five was the year we discovered the laser printer. We also discovered the problems of serial interfaces, complex command languages, limited support from software, and big price tags.

In 1986 the QMS Kiss changed all that. The Kiss comes with a parallel interface that supports a standard printer cable. It emulates three standard printers: the Epson FX-80, Diablo 630, and Qume Sprint. If you are replacing one of these printers, you probably won't have to reconfigure your software at all. If you buy new programs, chances are they will support one, if not all, of these emulations.

While the Kiss does not support graphics in its full 300-dot-per-inch resolution, it can produce razor-sharp Epson graphics, including downloadable fonts.

The price for this problem-free printer is $1,995 (a convenient shade under $2,000). QMS sells only through authorized dealers; so you probably won't find the Kiss discounted through the typical mail-order channels. When you consider what you get, though, list price is still a bargain.

The QMS Kiss "Keeps It Simple, Sweetheart." I hope it's the forerunner of more-powerful and even lower-priced laser printers for the PC market.—**Alfred Poor**

**FACT FILE: QMS Kiss;** QMS Inc., P.O. Box 81250, Mobile, AL 36689 (205) 633-4330 **List Price:** $1,995 **Reviewed:** Volume 5 Number 19 CIRCLE 682 ON READER SERVICE CARD

QMS Kiss

## Microsoft's Update Policy

It's always a happy day when my mail includes a heavy brown envelope from Microsoft Corp. Inside I'll find a form letter from Pat Crenshaw of Microsoft Customer Service and free update floppy disks for one of the Microsoft programs I own.

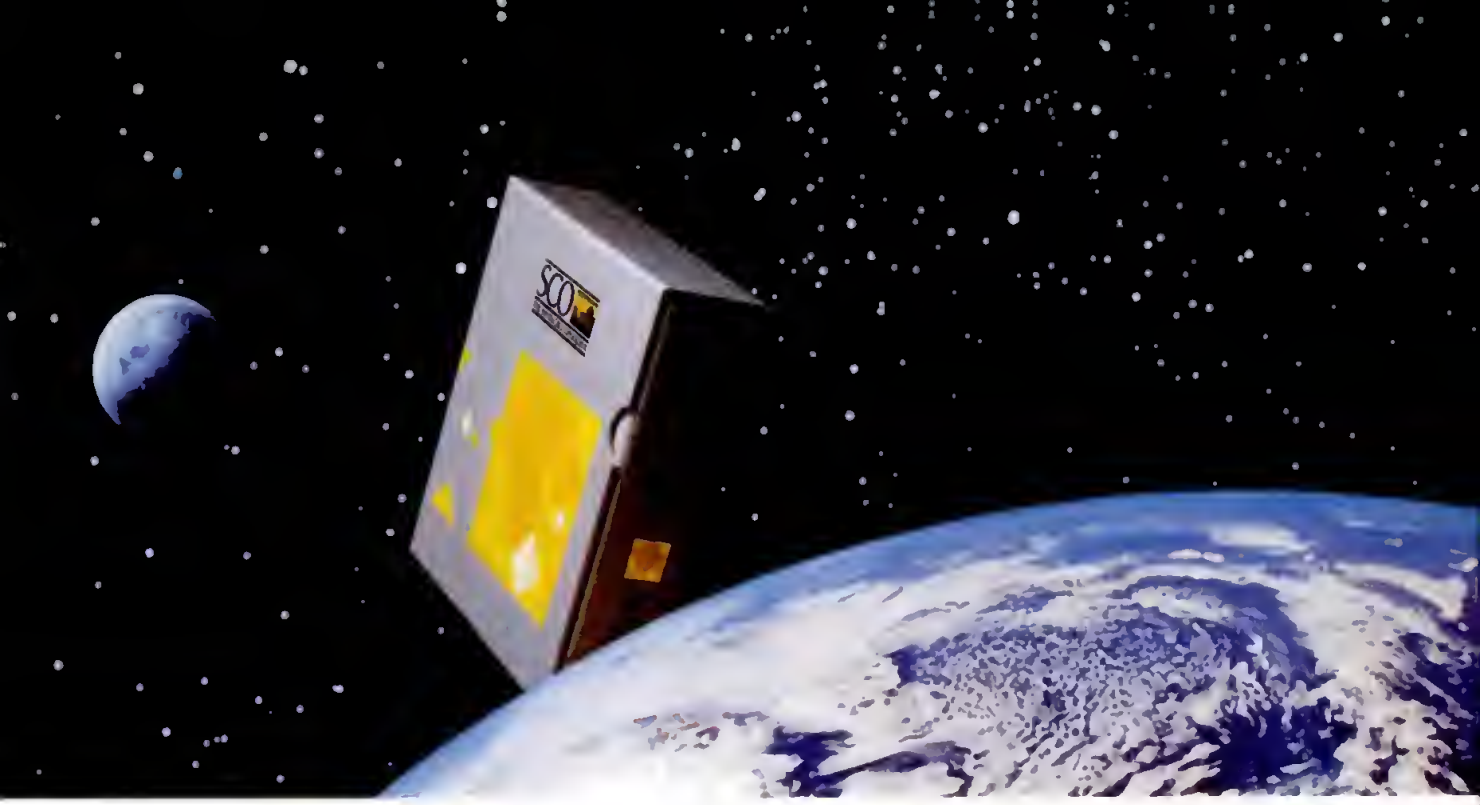
I get these free updates not because I am a contributing editor to *PC Magazine*, but because I filled out and mailed in a simple registration card after purchasing the software. In the past year I've received free floppy disks with bug fixes for QuickBASIC 1.0, improvements to Pascal 3.3, and a non-copy-protected version of *Access*.

Microsoft charges money

for updates only when new manuals are involved; the prices are reasonable, and the process quite painless—just fill out a short form and mail it with a check or credit card number. This is a model update policy.
—**Charles Petzold**

## XyWrite III, Version 3.1

XyQuest's *XyWrite* has long been my word processor. Breathtaking speed and exquisitely customizable flexibility—with no forced marches through thought-in-

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"Together with unparalleled SCO hot-line support, documentation, and training, plus the explosive growth of the XENIX applications base, it changed the way we would look at personal computers forever.

"In short, it was the 'SCO XENIX solution' that turned personal computers into *real* computers."

from *"XENIX RISING: The Ascent of Shared Information Computing from 1979 to 1999"*

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It sounds great; the idea of a speedup board that you can just plug right in as easily as putting bread in a toaster. How wonderful to be able to convert a PC or XT to a $4000 AT without the expense. But even when you get ready to spend $395.00 you want to be sure your choice is the very best.

Here at PCSG we sell our IBM PC disk access speedup software by the thousands. But software doesn't do anything about speeding up the microprocessor (or CPU) speed. As you know the microprocessor is the brain of the computer that controls all the operations like screen updates and calculations like a spreadsheet makes.

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We wanted to offer a speedup card that would be the compliment to our disk speedup software, (incidentally included at no extra charge.) We wanted it to be literally the most advanced, fastest, most feature rich board available today. We could only be satisfied with a board that was the finest example of the engineering art.

There is no question we have met our every objective by developing and manufacturing the *BREAKTHRU 286* card. This is the best designed and most functional speed up card available today. We guarantee it.

**HERE IS WHAT MAKES IT SO SPECIAL.**

**First, it installs so easily.** It is a half slot card, only five inches in length. You don't even have to give up a full slot. What's more, unlike competing products it works in the Compaq and most clones. The instructions are so simple we considered showing a picture of a child putting it in. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

**Second, it is advanced.** The *BREAKTHRU 286* replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. A 16K cache memory provides zero-wait-access to the most recently used code and data. In benchmark tests the card accelerated software programs—both custom and off-the-shelf anywhere from 200% to as much as 700%. Wow!

**Third, you have full compatibility.** All existing system RAM, hardware, and peripheral cards can be used without software modification. It operates with LAN and mainframe communication products and conforms to the Lotus/Intel/Microsoft Expanded Memory Specification (EMS). Software compatibility is virtually universal.

**Fourth, it is the best there is.** There are several other boards on the market. Some are priced about the same as the *BREAKTHRU 286* and some are cheaper. We at PCSG have compared them all, but there simply was no comparison. What we discovered is that many cards being sold offer only a marginal speed up in spite of their claims. We found some to be merely versions of the obsolete 8088 or 8086, and others to be just poorly engineered. The 8MHz *BREAKTHRU 286* is unequivocally the best executed and most completely reliable speedup board manufactured today.

PCSG has since early 1983 dominated the lap portable market with ROM software such as Lucid spreadsheet and Write ROM that reviewers rated as excellent. We were proud to successfully enter the IBM PC market last year with disk access speedup software. Now we are so pleased with the *BREAKTHRU* speedup card. We use them on our own PC's to make them faster than AT's. We are really excited about this product.

PCSG makes the unabashed statement that the *BREAKTHRU 286* card represents more advanced technology than boards by Orchid, Quadram, Victor, Mountain, P.C. Technologies, Phoenix... we could go on.

But an ad can't let you experience it for yourself. That's why we sell the *BREAKTHRU 286* on a 60 day trial. If you aren't completely satisfied return it within 60 days for a full refund. It is priced at $395. Call today with your MasterCard, Visa, American Express or COD instructions and we will ship your card the very next day. **CIRCLE 489 ON READER SERVICE CARD**


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terrupting menus—are *XyWrite*'s hallmarks, and they are primary considerations for a busy editor and writer.

*XyWrite III*, Version 3, which has been out only a year, has already been eclipsed by the powerful new features of *XyWrite III*, Version 3.1, a $35 update. From the program's command line you can now, as before, call, create, and delete files or see a sorted directory and search all its files for a word or phrase. You can also copy files, rename them, append them (in whole or part) to other files, find them anywhere on a hard disk (the equivalent of *The Norton Utilities*'s Filefind), call them up with wildcards (you go on to the next match by simply hitting Ctrl-N), and find difference points and matches between two files (using Ctrl-Dash and Ctrl-Equals sign). Directory listings can now include a user-selected amount of text from the start of the file. A new TREE command shows your subdirectory structure and makes changing directories easier.

Academics can now keep three sets of footnotes (and six kinds of page and footnote numbering) going, and they can sort indices according to criteria of their own devising. The rest of us will more often appreciate the choice of four different underlining modes and the inclusion of Today and Now date/time in-text markers. And, for serious desktop publishing applications, *XyWrite* 3.1 now supports variable leading and proportionally scaled font width tables.

The best gets better—and will continue to do so.
**—Craig L. Stark**

**FACT FILE:** ***XyWrite III*, Version 3.1**; XyQuest Inc., P.O. Box 372, Bedford, MA 01730 (617) 275-4439 **List Price:** $395; upgrade from Version 2.0, $200; upgrade from Version 2 Plus, $100; upgrade from Version 3.0 purchased before Sept. 1, 1986, $35; purchased after Sept. 1, free. **Requires:** DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 21 CIRCLE 667 ON READER SERVICE CARD

## DRAW!

Micrografx's *DRAW!*, a vector-based color drawing program, is one of the first third-party packages developed to run under *Microsoft Windows*. Because *DRAW!* is vector based, you have the ability to edit individual objects. You can move the images around, stretch them out, and rotate them. It's a great program for people like me who basically can't draw.

Since *DRAW!* runs under *Windows*, it supports any video display and any graphics printer that *Windows* also supports, either now or in the future. *DRAW!* takes advantage of *Windows*' clipboard facility, and so you can transfer a *DRAW!* drawing (or parts of one) into *Windows Write* (where it retains the color) or *Windows Paint* (where it is converted to black and white). It will also permit back and forth transfer between future *Windows* applications that use *Windows* metafiles. As a bonus, *DRAW!* includes a Lotus graph import facility that allows you to fancy up your *1-2-3* or *Symphony* graphs.

Is *DRAW!* easy to use? Let me put it this way: I dug out the *DRAW!* manual when I started to write this piece. It looks good (over 200 pages), but I can't recall ever having consulted it before.
**—Charles Petzold**

**FACT FILE:** ***DRAW!***; Micrografx Inc., 1820 N. Greenville Ave., Richardson, TX 75081 (214) 234-1769 **List Price:** $199; clip art catalog, $39.95. **Requires:** 320K RAM, 512K recommended; New versions operate independently of *Microsoft Windows*, DOS 2.1 or later. Not copy protected. **Reviewed:** Volume 5 Number 8, page 51 CIRCLE 671 ON READER SERVICE CARD

## PS Jet

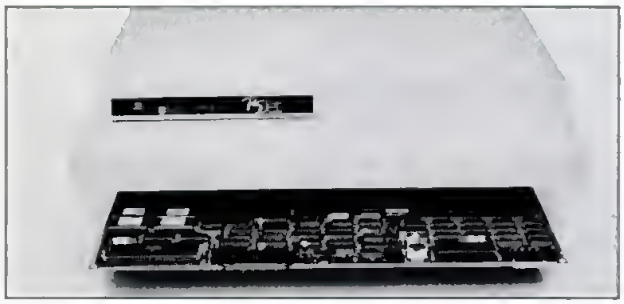
There's vision, and then there's *vision*. When Hewlett-Packard introduced its Laserjet printer in 1984, it looked like a wonderful, if somewhat pricey, way to produce great-looking letters, eliminate the clackety-clack of impact printers, and speed up the whole process at the same time. That was vision.

When Apple introduced its LaserWriter printer in early 1985, it introduced the concept of putting a powerful, easy-to-use typesetting machine on everybody's desk. That was vision.

But what about all those Laserjet owners (over 200,000 at last count)? They don't want to throw away an 80-pound machine that cost them between $2,400 and $4,000, depending on when they bought it, and spend another $5,000 to $6,000 on an Apple printer.

The Laser Connection saved the day when it introduced PS Jet. PS Jet is an ingenious way to give your trusty Laserjet a lobotomy

> PS Jet is an ingenious way to give your trusty Laserjet a lobotomy and turn it into the functional equivalent of an Apple LaserWriter. Any computer dummy with a screwdriver and two hands can install it.



and turn it into the functional equivalent of an Apple LaserWriter. It's a new, PostScript-based controller ensconced in a plastic case that replaces the top of a Laserjet. Any computer dummy with a screwdriver and two hands can install it. Once the surgery is performed, you end up with a 68000 processor, 2 megabytes of RAM, 512K bytes of ROM, four scaleable fonts, and the ability to print full-page graphics at 300 dots per inch. Most decent mainstream software programs, including all major PC desktop publishing programs, most word processors, and a smattering of databases, spreadsheets, and utilities, now support the PostScript standard.

PS Jet looks expensive: it lists for $2,995. But it saves the emotional trauma of admitting to yourself that you really shouldn't have jumped on the laser printer bandwagon quite that quickly (not to mention the additional $2,000 that a brand-new LaserWriter costs).

PS Jet represents the best of the innovative designs that let you transform old visions into new vistas without emotional and financial trauma.—**Stewart Alsop**

**FACT FILE: PS Jet;** The Laser Connection, P.O. Box 850296, Mobile, AL 36685 (205) 633-7223 **List Price:** $2,995 **Requires:** Hewlett-Packard Laserjet printer. CIRCLE 664 ON READER SERVICE CARD

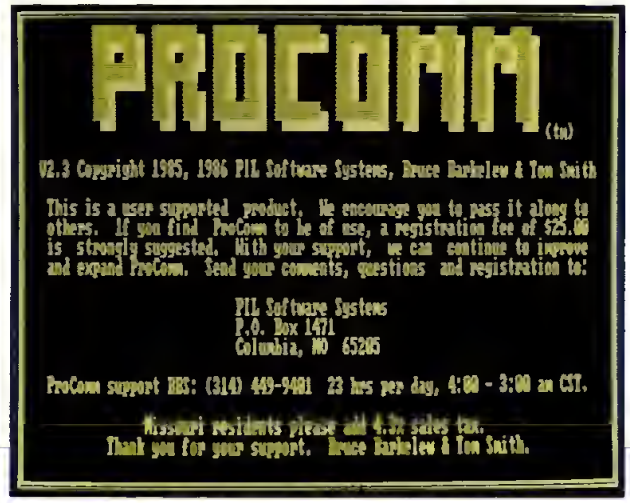
## ProComm, Version 2.3

Since I probably spend more time on-line than I do writing, I take communications software seriously. Over the past 3 years I've used "big name" commercial packages, shareware, and public domain software, but I didn't find what I would call an ideal communications program until I discovered PIL Software's *ProComm*, Version 2.3, in June.

*ProComm*, Version 2.3, is a shareware package, born and bred on the bulletin boards with which it communicates so well. Earlier versions resembled *PC-Talk III* and *Qmodem*, but the latest incarnation is in a class by itself. Of course, *ProComm* has all the features you'd expect: easily changed parameters, a 99-number phone directory, attack dialing, mnemonic Alt-key sequences, a callable text editor, and support for most flavors of Xmodem and Ymodem as well as Kermit and ASCII file transfer. What make *ProComm*, Version 2.3, special are the extras: sophisticated script processing, a host mode with two levels of password protection for access to the host's shell, a two-window chat mode for systems that support it, and a utility that will execute scripts at a predetermined time.

I'm so pleased with *ProComm* that I finally trashed all the other communications programs on my hard disk, with no regrets. The registration fee is a modest $25; for $50 you get the support, a printed manual, and a free update.
—**Tom Stanton**

**FACT FILE: *ProComm*, Version 2.3;** PIL Software, Box 1471, Columbia, MO 65205 (314) 449-9401 (RBBS) **List Price:** $25, voluntary (shareware). Not copy protected. CIRCLE 661 ON READER SERVICE CARD




*Communications features galore cost only $25 with* ProComm.

## Perspective

You don't have to need *Perspective* from Three D Software to appreciate it, but it helps. While most spreadsheet users are still questioning whether they need a charting package that

goes beyond *1-2-3*, *Perspective* has moved into the third dimension. It takes spreadsheet input and graphs it in 3-D, so you can look at three variables at once or compare groups of related numbers in two planes. If that were all *Perspective* did, it would be impressive enough, but *Perspective* does so in a way that is almost preemptive. It's certainly going to be hard to top.

*Perspective* allows you to tilt and rotate the graphs you create on all three axes, as well as stretch and compress them along the same axes. So no matter how complex your data, you can always come up with a graph that's readable. Most impressive, though, is the simplicity of *Perspective*'s user interface: It's a two-finger proposition. Even when you're customizing the most complex graphs, you're never using more than the function keys and the cursor keys.

My only complaints about

# Why Do They Look So Different But Cost About The Same?

**This is Toshiba 24 pin letter quality.**

This is 9 pin printer quality.

When we developed the P321 and P341e 3-In-One™ dot matrix printers, we had just two goals in mind.

Superb 24-pin letter-quality reproduction. And a price that's as close as possible to standard 9-pin models.

One look at the print sample shows you we succeeded. So will one look at the price.

In fact, we were so successful, we gave these 24-pin printers with the 9-pin price a special name: *The Affordable Class.*

And we included features—starting with type font cartridge capability—that put them in a class by themselves.

Both the Toshiba P321 and P341e printers produce letter-quality documents at 72 CPS, drafts at 216 CPS and high-resolution graphics at 180 x 360 dpi.

Each printer has our industry-standard P351 command set for more sophisticated word processing and high-resolution graphics.

And each printer has standard application compatibility with the entire IBM-PC[1] line of products.

Options include downloadable disk capability and type font cartridges for an unlimited range of type styles, a one- or two-bin sheet feeder as well as continuous forms tractor feeder.

*The affordable and compact P321:* If you're keeping an eye on the bottom line, we'd like to direct your attention to our P321. When it comes to virtually all business and correspondence needs, it fills the bill nicely.

You get letter-quality reproduction in a printer that looks great on the bottom line.

*The affordable extended-carriage P341e:* If you need to do full-size spreadsheets, you need our wide-carriage P341e.

Like the P321, the P341e uses our 24-pin printhead that lasts up to four times longer than other printheads, and has made us the number one seller in the business.

So buy a Toshiba Affordable Class P321 or P341e printer today. You'll get letters that look perfect every time.

*And a type font cartridge free.*

For the Toshiba printer and computer dealer nearest you, call 1-800-457-7777.

1 IBM-PC is a registered trademark of International Business Machines Corporation.
*Offer expires 2/15/87 See your Toshiba dealer for details. Or call 1-800-457 7777.

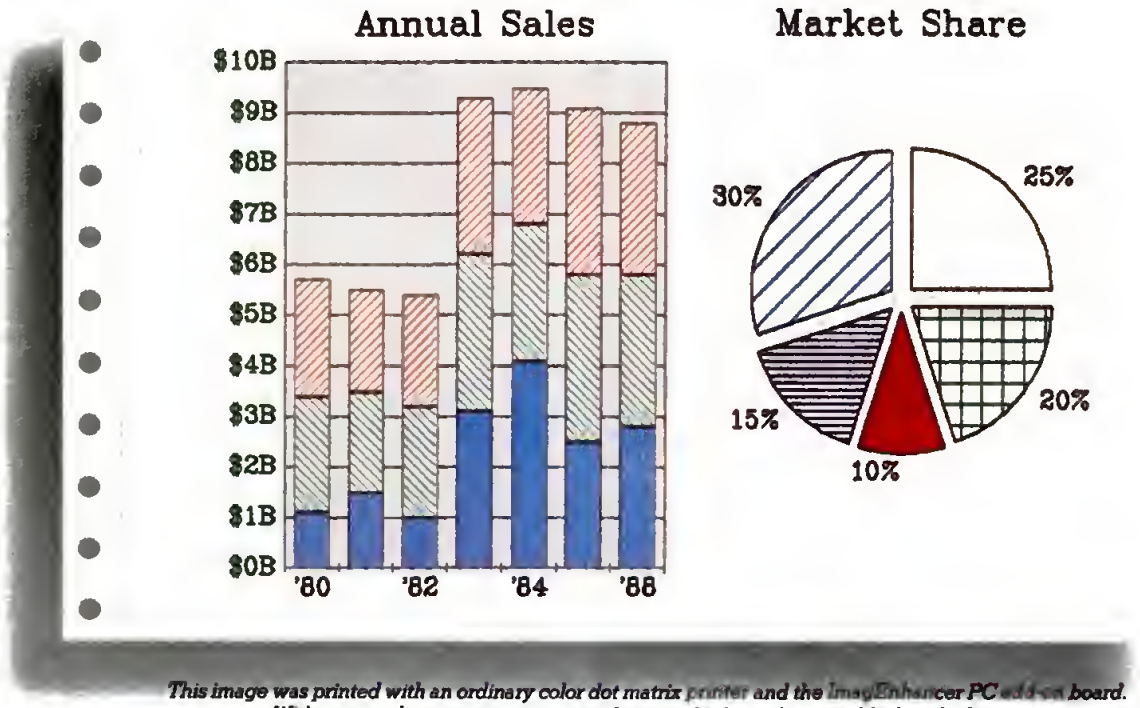
In Touch with Tomorrow

**TOSHIBA**

Toshiba America, Inc., Information Systems Division

CIRCLE 203 ON READER SERVICE CARD

# NEW DASH FOR YOUR OLD DOT MATRIX.




*This image was printed with an ordinary color dot matrix printer and the ImagEnhancer PC add-on board. With a monochrome printer, you get the same high resolution in black and white.*

Your old printer should look so good.

Introducing the ImagEnhancer™ PC add-on board. It enables ordinary monochrome or color dot matrix printers to produce high-resolution, plotter-like graphics.

**THE OUTPUT IS OUTSTANDING.**

The ImagEnhancer is the perfect way to get presentation-quality graphs, charts and artwork from your old dot matrix printer.

What's more, the ImagEnhancer is a vector to raster converter with 512K RAM on board. So while your printer is printing one job, you can use your PC for another.

And of course, the ImagEnhancer works with the same computer products most everyone works with. IBM® PCs, XTs, ATs or 100% compatibles with graphics capability. Alps, Epson® or Epson-compatible monochrome or color dot matrix printers. And Houston Instrument (DM/PL) plotter-compatible software, including Lotus® 1-2-3,® Symphony,® PFS®: Graph and Framework,™ among others.

**THE PRICE IS RIGHT**

At $595, the ImagEnhancer costs a fraction of what you'd pay for a new plotter. It's simple to install, too. And backed by a one-year warranty.

For more information, print samples, or the name of the dealer/distributor nearest you, write to Alps America, 3553 North First Street, San Jose, CA 95134. Or call **(800) 828-ALPS.** In California, (800) 257-7872. In Canada, (800) 858-2577.

And teach your old dot matrix some new tricks.

**ALPS**
*AMERICA*

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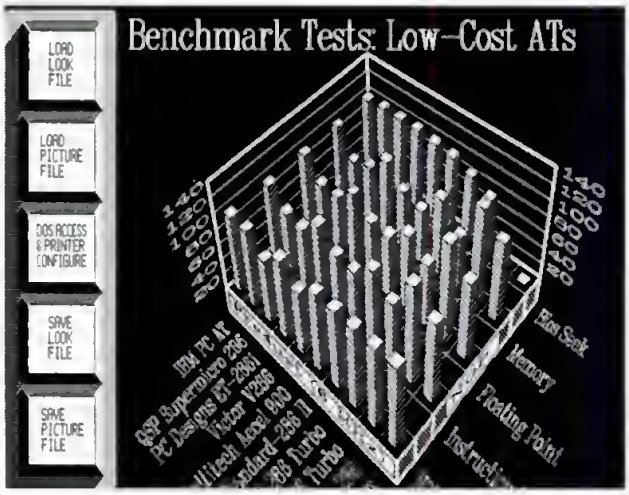



*We used* Perspective *to graph these PC Labs benchmark test results.*

*Perspective* were that you needed a Hercules card and that the printer output was fairly low in resolution. Three D Software solved both problems with an EGA version and a high-resolution laser printer driver.

We use *Perspective* to model the 3-D benchmark-test graphs in *PC Magazine*. They'd be almost impossible to do without it. Now if it just had plotter output . . .
**—Bill Machrone**

**FACT FILE: *Perspective*, Version 1.0;** Three D Software Inc., 860 Via de la Paz, Pacific Palisades, CA 90272 (213) 459-8525 **List Price:** $295; Version 2.0 with EGA color and laser printer support, $349. **Requires:** Hercules monochrome graphics card, monochrome monitor. Not copy protected. **Reviewed:** Volume 5 Number 22 CIRCLE 692 ON READER SERVICE CARD

## Compound Document Processor

Palantir Corp.'s Compound Document Processor is an exceptional text and graphics scanner. Unlike lower-priced systems that scan only monospaced fonts, the Compound Document Processor can scan and recognize monospace and true proportional typographic fonts, as well as graphics with 300-dot-per-inch resolution and halftoning for continuous tone. Character recognition and text formatting take less than 60 seconds per page, and the Compound Document Processor can retain most of the page attributes, such as multicolumn and text runarounds. Graphics are scanned at the same time and stored in memory for processing. The Compound Document Processor performs all these tasks automatically; since an operator doesn't need to train the CDP to recognize typefaces, novices can use it after only a few hours of practice.

Although Palantir's Compound Document Processor is designed to run on workstations, users of networked PCs can take advantage of its capabilities. Once DOS goes beyond the 640K-byte workspace limits, the Compound Document Processor will fit nicely into such PC-based applications as publishing, database management, and forms processing. Of all the scanners I've reviewed, the Compound Document Processor comes closest to performing routine scanning like any other office machine and therefore deserves serious attention.
**—Tom Stanton**

**FACT FILE: Compound Document Processor;** Palantir Corp., 2500 Augustine Dr., Santa Clara, CA 95054 (408) 986-8006 **List Price:** $39,500 **Requires:** 512K RAM for text, 1 Mbyte RAM for graphics; hard disk; color/graphics adapter for graphics; AT or compatible recommended. **Reviewed:** Volume 5 Number 16 CIRCLE 686 ON READER SERVICE CARD

## Mannesmann Tally 490

I'm not usually a fan of dot matrix printers, but the Mannesmann Tally 490 has turned my head. This heavy-duty printer has the ruggedness of an oversized brick and offers high-speed, low noise level, good print quality, and compatibility with both Epson and IBM graphics.

The MT 490's speed is its single most impressive feature. As a measure of printhead speed, Mannesmann Tally claims 400 characters per second in draft mode and 150 cps in near-letter-quality mode. As a measure of actual throughput, PC Labs speed tests clocked the MT 490 at 247 cps in draft mode and 123 cps in NLQ mode. You won't find many dot matrix printers in this class.

The printer's low noise level is just as impressive. PC Labs measured it at 67 decibels in draft mode and 65 decibels in NLQ mode. In either case, the printer's sound has an almost soothing, white-noise effect. A great deal of its 80-pound weight is apparently devoted to suppressing noise.

I was brought up to believe that Selectric-quality output was the minimum acceptable level for serious correspondence, and, let's face it, you just don't get that quality from a dot matrix printer. But given this printer's versatility, speed, and noise level, I'm willing to accept "merely" true NLQ mode.

You can buy a laser printer for about the same price as the MT 490's $2,199, and that laser will give you higher speed, less noise, and argu-

ably better print quality. But until you can show me how to feed envelopes for mass mailings on a laser, I'll keep the MT 490 high on my wish list.—**M. David Stone**

**FACT FILE: Mannesmann Tally 490;** Mannesmann Tally, 8301 S. 180th St., Kent, WA 98032 **List Price:** $2,549 **Reviewed:** Volume 5 Number 19 CIRCLE 663 ON READER SERVICE CARD

## Lightning

A disk-caching program sounds about as exciting as a toenail clipper. But Personal Computer Supply Group's *Lightning* clips delays out of just about any software that makes repeated disk accesses and any program you exit and reenter often. It's like half a RAMdisk with none of the fuss.

The first time you load a program or your software reads a file, *Lightning* stuffs it into RAM. When you subsequently recall the program or your software recalls unchanged data, it happens with RAM speed rather than disk sloth.

However, *Lightning* doesn't mess with data headed for the disk. Unless such data is absolutely unchanged, it goes to magnetic safety forthwith. That keeps your file allocation tables, disk directories, and information safe and sound in the event of program crash or a power glitch.

Unless you're a RAMdisk adept, *Lightning* is almost mandatory for programs like *WordStar* that use overlay files repeatedly. Databases, thesauruses, and spelling checkers that reuse the same data are also potential candidates for *Lightning*'s magic. So are compilers, linkers, and other tools you constantly access and reaccess.

The program can use both regular RAM and expanded memory, it can work with disks both floppy and hard, and it's been utterly trouble free in the year I've used it. Tell it in one line of AUTOEXEC.BAT how much memory you want it to use and exactly which disks you want it to cache, and you needn't bother to communicate with it again.

*Lightning* comes free with Personal Computer Supply Group's Breakthru 286 accelerator card (a fine performer in its own right), but it's eminently worth paying for. Its biggest problem is that people keep confusing it with Borland's overhyped *Turbo Lightning*. Here the turbo performance is in the product rather than the name.
—**Stephen Manes**

**FACT FILE: *Lightning;*** Personal Computer Supply Group Inc., 11035 Harry Hines Blvd., Dallas, TX 75229 (214) 351-0564 **List Price:** Copy protected, $49.95; not copy protected, $89.95. **Requires:** 128K RAM. **Reviewed:** Volume 5 Number 5 CIRCLE 672 ON READER SERVICE CARD

## NEC Pinwriter P5XL Toshiba P351C

Laser printers garnered most of the printer world's attention in 1986, but the NEC Pinwriter P5XL, from NEC Information Systems, and the Toshiba P351C, from Toshiba America, showed that printers don't have to look like jazzed-up copy machines to be state of the art.

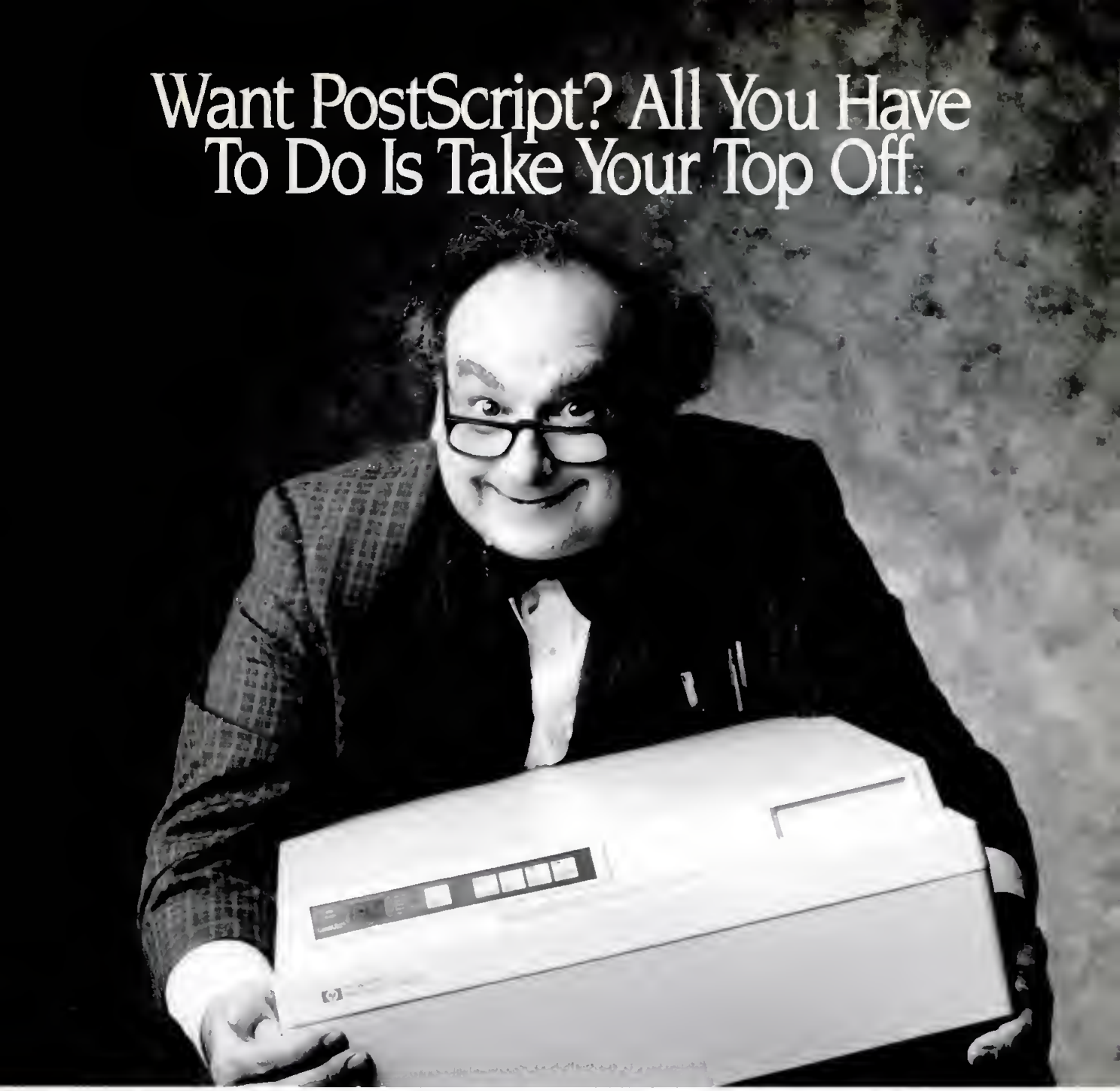
Both these products use 24-pin dot matrix technology to produce copy that effectively bridges the gap that used to exist between speed, graphics, and print quality. With draft speeds just under 300 characters per second and letter quality output at around 100 cps, you might think of these two products as a poor man's laser printer. If you are still laboring with a first- or second-generation dot matrix

### Contributors

The following talented and opinionated people participated in The Best of 1986:

**Staff editors:** Stewart Alsop, West Coast editor; Bill Howard, executive editor; Bill Machrone, editor; Paul Somerson, executive editor; Craig L. Stark, technical editor; William G. Wong, director of PC Labs. **Contributing editors:** John Dickinson, Stephen Manes, Charles Petzold, Winn L. Rosch, Jim Seymour. **Free-lance Writers:** Christopher Barr, Bruce Brown, Diane Burns, Jon Pepper, Alfred Poor, Vincent Puglia, Robin Raskin, Richard W. Ridington, Jr., Tom Stanton, M. David Stone, S. Venit.

# Want PostScript? All You Have To Do Is Take Your Top Off.



Daring? You bet. But the revolution demands that you do something revolutionary.

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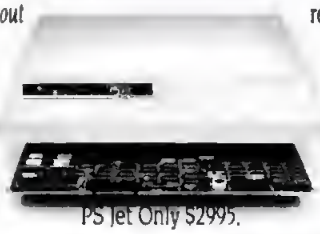
Just take your top off and put on PS Jet, the PostScript enhancement from The Laser Connection.™ It replaces the top cover assembly on laser printers from H-P, Canon,® NCR® and OMS.® And PS Jet provides 13 typefaces, in any point size, for 100% compatibility with the Apple® LaserWriter™ and it supports all PostScript programs available for your IBM®PC.™ You don't have to buy a new printer to join the desktop publishing revolution. You just need to perform a revolutionary act. Like mailing in this coupon to find out more about PS Jet.™ Or calling 1-800-441-4040. (In Alabama, call 1-633-7223).



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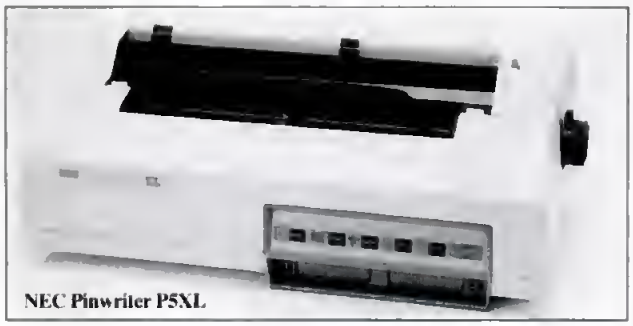
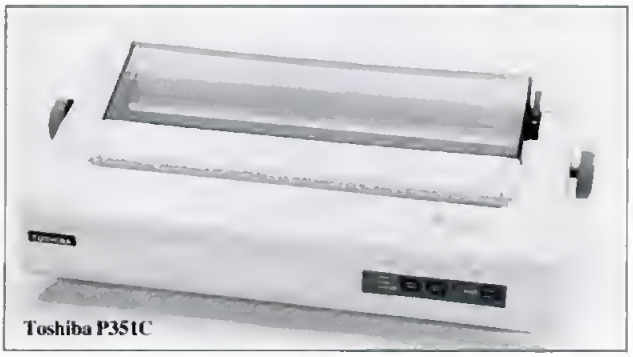
CIRCLE 143 ON READER SERVICE CARD



NEC Pinwriter P5XL



Toshiba P351C

printer, a quick look at the NEC or the Toshiba will very likely stir up a bad case of printer envy.

Both machines are fast, rugged, and reliable, and they feature plenty of built-in and optional fonts and high-resolution graphics. Both also offer color printing with an optional ribbon (in their top-of-the-line configurations). The NEC might have a slight edge on the basis of its ease of use and the capability of printing with a multistrike ribbon, but the edge is slight, and the Toshiba is too good a machine to ignore. We'll call it a photo finish.

If these printers have a drawback, it might be the relative lack of software currently available to drive them to their full potential. Otherwise, both are fine choices for anyone who needs high speed, excellent print quality, and graphics on a budget that excludes a laser printer.

**—Jon Pepper**

**FACT FILE: NEC Pinwriter P5XL;** NEC Information Sytems Inc., 1414 Massachussetts Ave., Boxborough, MA 01719 (617) 264-8000 **List Price:** $1,695 **Reviewed:** Volume 5 Number 19 CIRCLE 680 ON READER SERVICE CARD

**FACT FILE: Toshiba P351C;** Toshiba America Inc., Information Systems Div., 2441 Michelle Dr., Tustin, CA 92680 (800) 457-7777, (714) 730-5000 **List Price:** $1,749 **Reviewed:** Volume 5 Number 19 CIRCLE 684 ON READER SERVICE CARD

## VP-Planner

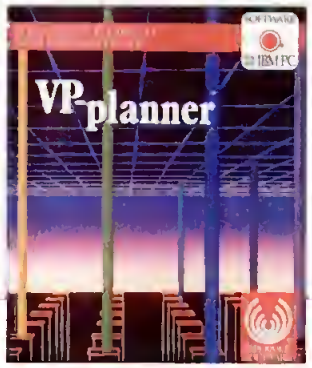
What's wrong with most spreadsheets? They're great at analyzing information but terrible at storing it, creating massive redundancy (and therefore, reliability) problems. The memory residence that gives them their analytical speed also limits their capacity (or forces you into expensive add-on hardware). A bevy of financial modeling programs solve these problems but only at the expense of the ease of use that spreadsheet users demand.

Enter Paperback Software International's *VP-Planner:* It's a spreadsheet compatible with Lotus's *1-2-3*, Release 1A's spreadsheet, database, graphics, and macros. It's a powerful database that allows you neatly to store numeric data from the spreadsheet and retrieve it as needed. It's a *dBASE* interface that allows you to create, query, and join *dBASE II* or *III* files from your spreadsheet.

The most innovative of its features, the multidimensional database (MDD), allows you to use a separate database file to feed data into your spreadsheet when you need it. Furthermore, while a typical spreadsheet can deal with at most two dimensions, the MDD allows you to specify up to five dimensions of data. Changing the mix of dimensions from which you ask questions is simple and requires no spreadsheet reformatting.

Although powerful, the MDD is a first-generation effort that appeals primarily to the power user crowd. Its user interface is radically different from that found in the spreadsheet part of the program, and its operation makes it easy for spreadsheet users to make errors or achieve misleading results. These caveats aside, *VP-Planner* is the only product making real strides to push back the limits of spreadsheet technology without throwing out the spreadsheet in the process, and that effort merits recognition.

**—Richard W. Ridington, Jr.**




**FACT FILE: *VP-Planner*, Version 1.21;** Paperback Software International, 2830 Ninth St., Berkeley, CA 94710 (415) 644-2116 **List Price:** Copy protected, $99.95; not copy protected, $109.95. **Requires:** 256K RAM, one disk drive, DOS 2.0 or later. **Reviewed:** Volume 5 Number 17 CIRCLE 687 ON READER SERVICE CARD

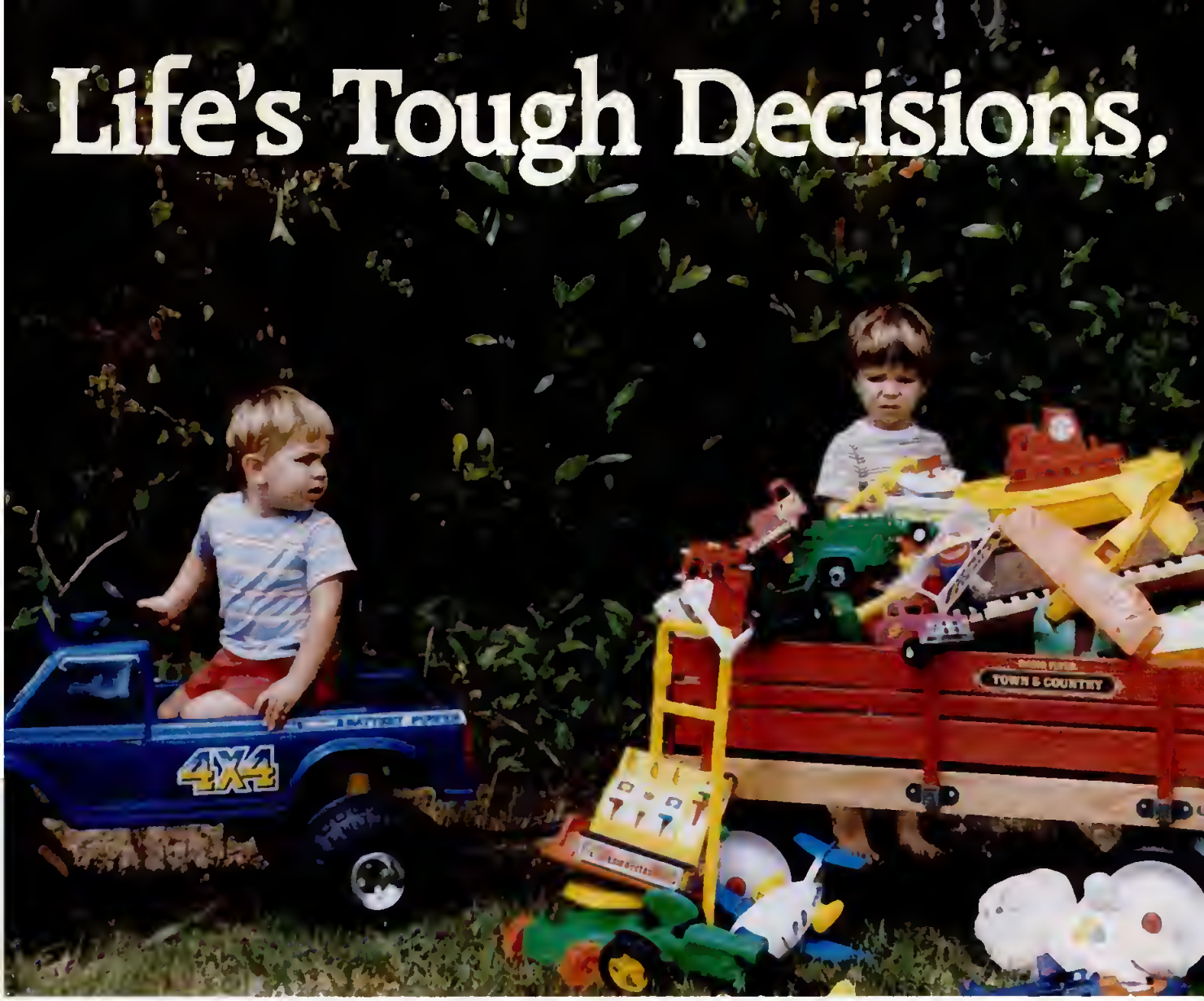
## Tallgrass Network Server and VINES

LANs should be easy to use, easy to set up, and easy to expand. The Tallgrass Technologies' Network Server with Banyan Systems' *VINES (Virtual Networking Software)* is just such a product. It is compatible with existing network hardware such as the IBM Token-Ring Network and 3Com's Ethernet, and the server supports any mix of up to four network interface cards. So you can tie existing networks together or try out new hardware using the same server.

You can connect multiple servers through a LAN interface or a serial port, and any node in the network can use any server. High-speed modem links make cross-country networks feasible. The electronic mail system is even smart enough to forward mail when a new server is connected to the network.

An excellent soloist is remarkable. An excellent orchestration is a joy. Making all the pieces play together is what the Tallgrass Network

# Life's Tough Decisions.




**THE CHOICES.**

Remember when your biggest problem was no storage space in your wagon? No room for your boats, trains, cars, and planes. Your choice was to either get rid of some toys or get a bigger wagon.

Now your *wagon* has turned into an IBM PC-XT. Your boats, trains, and cars are now database, spreadsheet, and word processing files. But your choice for more storage is still about the same: either get rid of some "toys" or get a bigger "wagon."

**GETTING A BIGGER WAGON.**

Since every bit counts, you can now upgrade your computer with a CORE 43 MB half height drive and still give yourself room to grow. IBM's standard XT contains only a 10 or 20 MB full height drive, which filled up faster than you thought it would. Your PC-XT may even accomodate 2 CORE drives. That's 86 MB and a floppy all inside the box.

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Contact us directly or see your local CORE Authorized Dealer for details.

XENIX is a trademark of Microsoft, Inc

CIRCLE 225 ON READER SERVICE CARD

Tallgrass Network Server and *VINES*

Server and the *VINES* operating software are all about. **—William G. Wong**

**FACT FILE: Tallgrass Network Server and *VINES;*** Tallgrass Technologies Corp., 11100 W. 82nd St., Overland Park, KS 66214 (913) 492-6002 **List Price:** Model 10 (43 Mbytes formatted), $8,495; Model 20 (70 Mbytes formatted), $9,995; Model 30 (120 Mbytes formatted), $13,995; *VINES* operating software, $1,895. **Requires:** DOS 2.0 or later.

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**rgPlus**

Give me an *Oh!* Give me an *Are!* Give me a *Gee!* Give me *OrgPlus*.

Banner Blue Software's *OrgPlus* is dedicated to the distinct possibility that at

# TREND OF THE YEAR: DESKTOP PUBLISHING

The computer industry is traditionally full of dissenting opinions, but everyone agreed on two things in 1986: that desktop publishing is one of the most important new applications around, and that no one is quite sure what *desktop publishing* means. Is it a market? An approach? A product category? A daydream?

Desktop publishing is a promise, the promise that soon we will be able to create beautiful graphics with our PCs, easily, and merge them, easily, with typeset-quality text on pages that we will print on low-cost, high-resolution printers (easily), ready for publication and distribution alongside professionally published books, magazines, and newsletters.

No inexpensive, easy-to-learn, effective desktop publishing solutions were available for the PC until recently. The first page composition products, released over the past 2 years, were priced too high to fit most "desktop" budgets. Most of them require complex typesetting codes and are compatible with a limited number of printers and typesetting machines. They are attractive to publishing departments in large corporations, but they have not made an impact at the broader level of business reports and in-house newsletters where most of us dwell.

The one page composition program for the PC that *is* inexpensive and easy to use, *ClickArt Personal Publisher* from Software Publishing Corp., is effective for short documents, but unfortunately it has some inherent limitations that make it less useful for long books or reports.

In the last quarter of 1986 the first few typesetting and page composition packages priced below $1,000 and designed to work with low-end laser printers appeared; before the first quarter of 1987 is over, more than a dozen will be available. If you're starting with a plain-vanilla 256K-byte PC, you'll need to add more memory, a graphics card, and possibly a color monitor. Then what?

Chances are you won't be able to produce slick publications overnight just because you've added some new software and upgraded your equipment. Pioneers who rush out to buy these new products are likely to suffer the growing pains of this new field. They'll have lots of questions: Can the page composition program do anything with our spreadsheet's graphics? Will our printer handle all the typefaces the software offers? Too often, they won't be happy with the answers they'll get.

Will the manufacturer of your chosen package last through the first year? That's another question you'll want to ask. Until recently, only a few, mainly obscure companies made page composition systems for the PC. Now everyone seems to be getting into the race, from one-man programming shops to major leaguers. Xerox, the company that truly pioneered this field, is releasing a page composition program for the IBM PC that will be in direct competition with its own Xerox Documentor system, a page composition workstation. Ashton-Tate and Software Publishing have recently joined the ranks of those companies developing page composition programs.

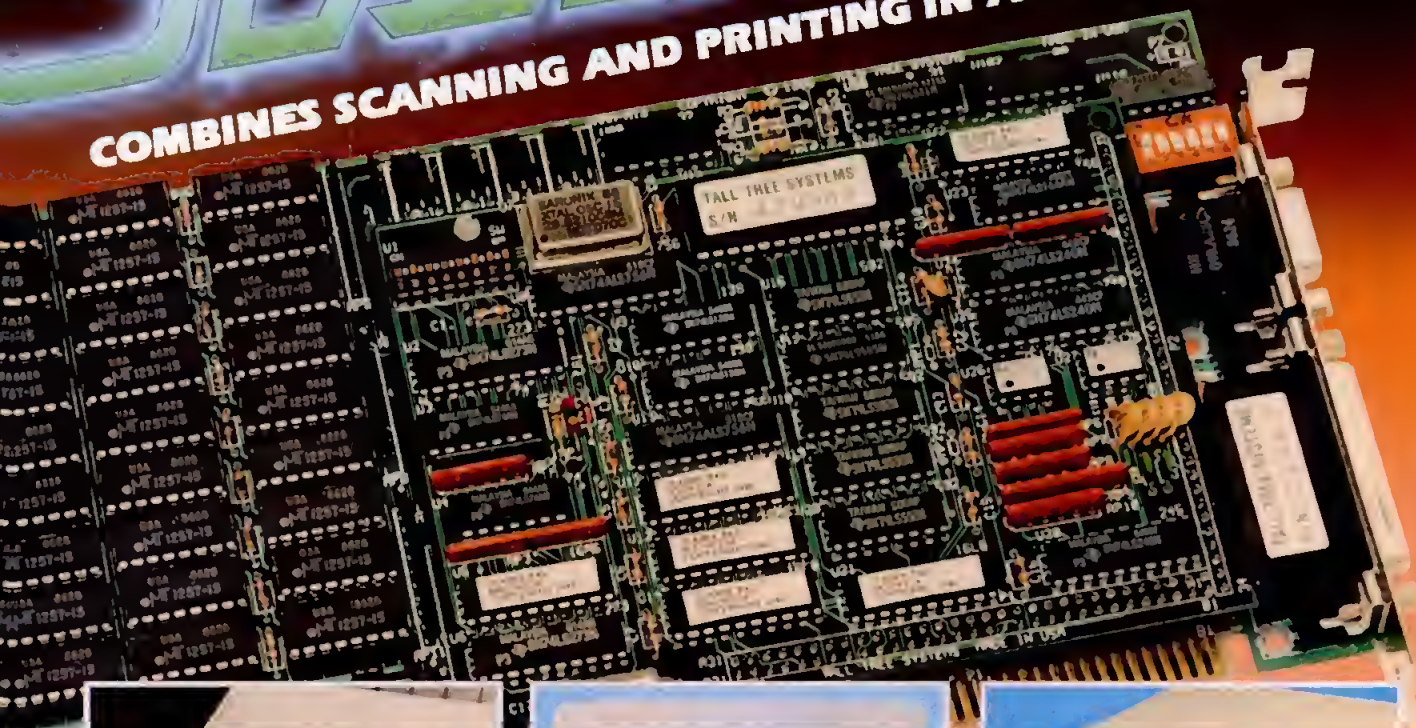
The page composition software market isn't the only battleground. Laser printer manufacturers are competing to make typesetting fonts like Times Roman and Helvetica available on their equipment. Major battles are being waged to determine the de facto standard page description language for linking page composition software with laser printers.

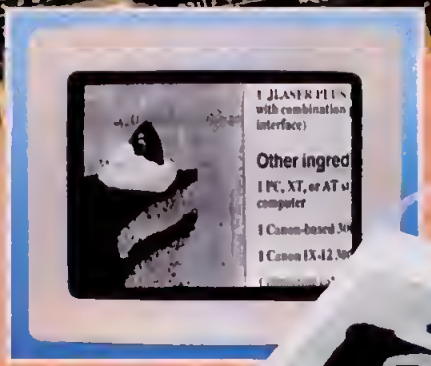
With so many investing in this new concept, desktop publishing is not likely to be a passing fad. As participants, we tend to think of its impact on those who produce the words, but its ultimate impact will be on those who read. Some of us believe that the impact of desktop publishing on today's world will be as significant as Gutenberg's was in his time.**—Diane Burns and S. Venit**

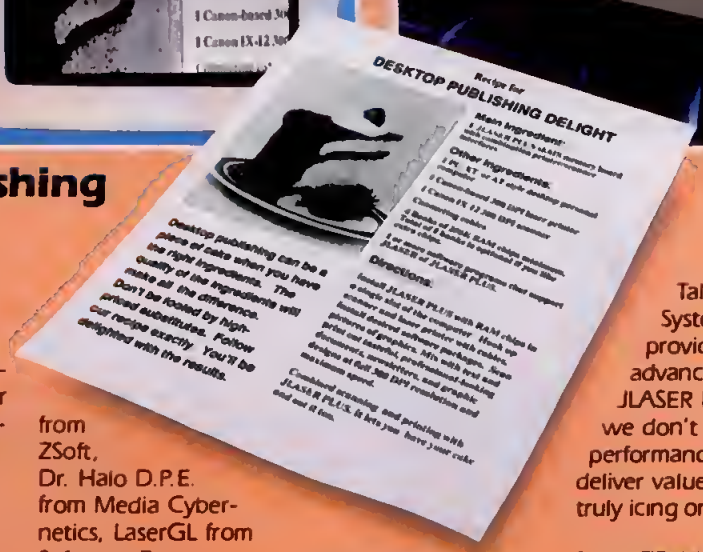
*Diane Burns and S. Venit are frequent contributors to* PC Magazine. *They own Tech-Art, a desktop publishing company in San Francisco.*

# JLASER PLUS

## COMBINES SCANNING AND PRINTING IN A SINGLE BOARD!








## It makes desktop publishing a piece of cake!

Tall Tree Systems introduces another breakthrough in desktop publishing with JLASER PLUS. We've combined a 2 MB EMS memory board and an interface to both a Canon®-based laser printer and scanner. JLASER PLUS increases the performance of both devices and gives you a low-cost solution to the limitations you've been experiencing with them.

Furthermore, the same memory that is made available to your printer and scanner is also available for all your other conventional applications. You get system memory, expanded LIM memory, extended memory in an AT-type machine, RAM Disk and print spooler — all in a single slot!

Supporting JLASER PLUS is a host of software packages, such as PC Paintbrush + from ZSoft, Dr. Halo D.P.E. from Media Cybernetics, LaserGL from Software Express, Ventura Publisher from Xerox, Page Builder from White Sciences, Le Print from Le Baugh Software, Fancy Font and Fancy Word from SoftCraft, Inc., and many more to be announced.

It takes a technological innovator like Tall Tree Systems to provide a major advancement like JLASER PLUS. And we don't stop at performance. We also deliver value, which is truly icing on the cake.

**TALL TREE SYSTEMS**
1120 San Antonio Road
Palo Alto, CA 94303
(415) 964-1980

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**TALL TREE SYSTEMS**

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some time in your life you'll get stuck putting together an organizational chart. Nothing else does it as quicky or neatly as *OrgPlus*.

You feed *OrgPlus* a list of who works at the company, their titles, who they report to, and where they rank on the pecking order. *Org* quickly prints out a chart showing the corporate organization. For big companies or departments, you can print the chart with *Sideways* or paste together multiple sheets. As employees change jobs, you can move them (alone or with the people who report to them) without redoing the whole chart.

Unlike, say, *1-2-3* or *WordStar*, *OrgPlus* isn't an everyday power tool for your PC. It's a handy accessory and worth every penny of its reasonable price.

**—Bill Howard**

**FACT FILE: *OrgPlus*;** Banner Blue Software Inc., P.O. Box 7865, Fremont, CA 94537 (415) 794-6850 **List Price:** $69.95, upgrade from *Org*, $20. **Requires:** 256K RAM, printer or plotter for output, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 4, page 53 CIRCLE 659 ON READER SERVICE CARD

## LPS P2000

In a world full of laser printers and 18- or 24-pin dot matrix wonders, many people consider a 9-pin printhead old news. Not me: the speed, print quality, and other thoughtful features of the ALPS P2000, from ALPS Electric (USA), make this wide-carriage 9-pin matrix printer my favorite new printer of the year.

Rated at 250, the ALPS P2000 prints 138 characters per second in draft mode, not bad for an under-$1,000 printer. The ALPS P2000 creates letter quality text at 39 cps and achieves as good print resolution as one can reasonably expect from a dot matrix printer.

ALPS P2000

The standard 4K-byte buffer can be expanded to 260K for copying stored text or downloading user-created fonts. The ALPS P2000 has two font cartridge ports and a front-mounted control panel that allows easy selection and control of type mode, pitch, line spacing, and fonts.

My favorite feature is a push-pull tractor-feed mechanism that you can easily switch, pulling to keep multipart forms straight and pushing to allow bidirectional paper control.

The ALPS P2000 prints both IBM high- and low-order character sets. It's text compatible with the IBM Proprinter and the Epson MX-80 and graphics compatible with the Epson MX-80, FX-80, and FX-85 and the IBM 5152 Graphics Printer and Proprinter.

The ALPS P2000 is the Volkswagen GTI of printers: it's rather inexpensive but performs with quality and speed.**—Bruce Brown**

**FACT FILE: ALPS P2000;** ALPS Electric (USA) Inc., 3553 N. First St., San Jose, CA 95134 (408) 946-6000 **List Price:** $995 **Reviewed:** Volume 5 Number 19 CIRCLE 673 ON READER SERVICE CARD

## WordPerfect, Version 4.1

Writers discussing the merits of their favorite word processor can make ardent evangelists preaching their faith pale by comparison. When Satellite Software International updated its popular word processor by releasing Version 4.1, it increased the number of its zealous "ministers" considerably.

In Version 4.1, *WordPerfect* adds side-by-side columns, three-level undelete capability, a superb on-line thesaurus, an expanded spelling checker, and more. *WordPerfect*, Version 4.1, is everything a word processor should be, and then some. It's fast, flexible, and crammed with useful features, and it's appropriate whether you're working on a short letter or a novel. What's more, it manages to accomplish all it does in an unobtrusive manner that supports rather than overshadows your writing.

Beginners can use *WordPerfect*, Version 4.1, effectively within a short time, but it also packs plenty of power for experienced us-

ers to master. Against any competition, *WordPerfect*, Version 4.1, is as good as word processors get.

**—Jon Pepper**

**FACT FILE: *WordPerfect*, Version 4.1;** Satellite Software International, 266 W. Center St., Orem, UT 84057 (800) 321-4566 **List Price:** $495 **Requires:** 256K RAM, two floppy disk drives, DOS 2.0 or later. Not copy protected. **Reviewed:** Volume 5 Number 12, page 38 CIRCLE 663 ON READER SERVICE CARD

## Scientific Micro Systems OMTI 5527 RLL Hard Disk Controller

Although hard disk prices bottomed out in 1985, the price of mass storage was pushed down another 50 percent during 1986 with the introduction of Run Length Limited (RLL) hard disk controllers. By altering the way

information is coded on-disk, the new RLL controllers boost the storage capacity of most hard disks by half.

As a bonus, RLL allows information to be shifted to and from the disks faster. The theoretical speed boost is also 50 percent. In practice, the performance is not that good, but it's still a big improvement over the previous standard technology, Modified Frequency Modulation.

One of the first to introduce a PC-compatible RLL controller was Scientific Micro Systems. Stepping a bit beyond the competition, the company's OMTI 5527 RLL controller also boasts another space-gaining feature: a short card that can be squeezed into slot 7 of an XT.

I've tried several RLL systems and found the SMS OMTI 5527 at least equal to them all. Its optional *OMTIdisk* software (which you'll really need) proved to be the easiest and fastest means of setting up and customizing an XT hard disk.

The SMS OMTI 5527 is not a plug-in replacement for the IBM-installed XT controller disk; RLL requires a somewhat-higher-quality disk than the one supplied with the XT. But in a new XT system that's purchased without a hard disk, the 5527 will give you the near-maximum DOS single-disk capacity, 30 megabytes, from an inexpensive 20-megabyte drive.

**—Winn L. Rosch**

**FACT FILE: Scientific Micro Systems OMTI 5527;** Scientific Micro Systems Inc., 339 N. Bernardo Ave., Mountain View, CA 94039 (415) 964-5700 **List Price:** $169 **Requires:** RLL-compatible hard disk, DOS 2.0 or later. **Reviewed:** Volume 5 Number 21 CIRCLE 666 ON READER SERVICE CARD

# FAST • EASY • PRICED RIGHT

Widely acclaimed because it's FAST EASY and PRICED RIGHT (still only $65), TurboTax may be the best software purchase you ever make!

**FAST** TurboTax calculates a complete tax return in just three seconds. No kidding! This speed is just the ticket you need for finding the best way to file. "What-If" calculations are a snap at three seconds a pop!

**EASY** TurboTax is easy to use. Pop-up menus and windows abound, creating the most natural computer interface you're likely to see. Look at these features:

- On-line help
- Pop-up menus
- Over 30 forms
- Pin-fed 1040s included
- Full depreciation support
- Automatic supporting schedules
- Pop-up calculator and notepad
- Full override capability
- 1987 planning included FREE!
- IRS approved printouts on your personal printer

**PRICED RIGHT** Simply put, TurboTax is the best tax preparation progrem available anywhere. And the price is so low, it makes the competition blush. To get yours, see your local dealer, or order direct $65 + $5 shipping CA rasidents 6% sales tax Visa MC accepted Integrated state returns available for most states —only $40 each 30-day money-back guarantee

**$65**

**CRITICS AND USERS AGREE**

1986 PC WORLD WORLD CLASS AWARD

*"World Class Winner"—PC World readership, October 1986.*

*"TurboTax is fast to learn, fast to use, fast to print your return."—Jim Saymour, syndicated columnist, March 1986.*

*"TurboTax takes the prize for most forms our favorites for this review ware TurboTax"—InfoWorld, March 1986.*

*"Flaxible, Affordable and Completa —PC Magazine, April 1985 "It makes doing your taxes almost fun"—all, Alvernaz, PC Magazine, April 1985.*

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Form 1040, A-B-C-D-E-F-G-K1-R-SE-W-ES Forms 2106, 2119, 2210, 2441, 3468, 3903, 4136 4255, 4562 4684, 4797, 4952, 4972, 6251, 6252 Plus Worksheets D, E Depreciation & What-If

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| SuperCalc®4 | | Lotus® 1-2-3® Release 2 |
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| **THE PRODUCT** | | |
| SuperCalc has been consistently recognized as a leader in technology since it was first shipped in 1980 | **Bloodline** | 1-2-3 was first shipped in 1983 |
| Excellent coexistence with Lotus 1-2-3 Release 1A or 2 | **Compatibility** | Does not co-exist as well with its sire, Release 1A |
| SuperCalc has never been copy-protected | **Copy Protection** | Yes—though Lotus has recently deemed that the Federal government and certain select corporations may be exempt |
| **THE PRICE** | | |
| $495 including SIDEWAYS® printing and other utilities | **Pricing** | $495 for the "engine"—add-ons cost extra |
| Discounts starting at 50% for 25 units or more with flexible delivery options | **Corporate Licenses** | Discounts to be negotiated but only for 500 units at a time, shipped to a single location |
| Yes | **Unlimited Site Licenses** | No |
| 1-2 units—$150 each; 3 or more units—discounted (for example, maintenance on 25 units is $89 per unit). Includes unlimited number of calls to senior technicians for initial term of 18 months | **Maintenance Cost** | $150 per contract, limited to 8 calls to a senior technician |
| Yes, with Maintenance | **Free Upgrades** | No |
| **THE COMPANY** | | |
| Computer Associates | **Company** | Lotus Development Corp. |
| 10 years | **Years in Business** | 4 years |
| Over $200 million | **12 Month Revenue (to June 30, 1986)** | Over $200 million |
| **INFOWORLD'S RATINGS** | | |
| InfoWorld, August 11, 1986<br>"SuperCalc4 is Serious Competition for 1-2-3"<br>Rated 4 disks (8.1) | | InfoWorld, December 2, 1985<br>"1-2-3, Release 2 is Not a Must Buy"<br>Rated 4 disks (7.4) |

## The Experts' View

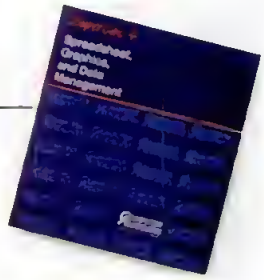
*"CA [SuperCalc] has led the way time and again with infinitely better graphics, support of the 8087/80287 math coprocessor, sparing use of RAM... all of the features that Lotus [1-2-3] should have provided a couple of releases ago."*
*—Jim Seymour, PC Magazine 9/1/86*

*"With SuperCalc4's newly extended file compatibility with 1-2-3, corporate managers can contemplate having the two products side by side without creating mutually exclusive camps of users."*
*—InfoWorld 8/11/86*

*"I have seen similar utilities (as those included in SuperCalc4 at no extra charge) sold for £50 [approximately $75] each as tools for 1-2-3. The (SuperCalc4) utility disks also give you the latest version of the SIDEWAYS program."*
*—PC Users Magazine (UK) 8/86*

*"The comprehensive support plan, site licensing, enlightened warranty, and lack of copy protection earn SuperCalc4 an excellent rating in support."*
*—InfoWorld 8/11/86*

*"Walter Kennamer, senior manager ... [at] Ernst and Whinney... does not feel that avoiding the major vendors means settling for second best. 'I have no trouble at all defending the proposition that SuperCalc is a better product than Lotus 1-2-3. But even if Lotus [1-2-3] had been better than SuperCalc, we wouldn't have standardized on Lotus, because they weren't willing to do business with us on terms we could accept.'"*
*—ComputerWorld 9/1/86*

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- ☐ Copies of SuperCalc4 reviews

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SIDEWAYS is a registered trademark of Funk Software.

CIRCLE 319 ON READER SERVICE CARD

# ABORT, RETRY, IGNORE

*What passes for progress in the personal computer industry is often relative—two steps forward tempered by one step backward. PC Magazine, herewith, coins the error messages appropriate to this year's collection of bugs, bombs, and backward moves.*

Illustrations: Robert Pizzo

## We'd Like to Point Out That They're Married

The model in Recreational Technology's *Interlude II* ads who tells her partner to bring home some spurs is wearing a wedding ring—but we can't tell you where she's wearing it.

## It's Not a Bug, It's a Feature, Part 1

In the name of compatibility with a de facto standard, several dozen EGA card makers were forced to emulate virtually all of IBM's EGA bugs.

## It's Not a Bug, It's a Feature, Part 2

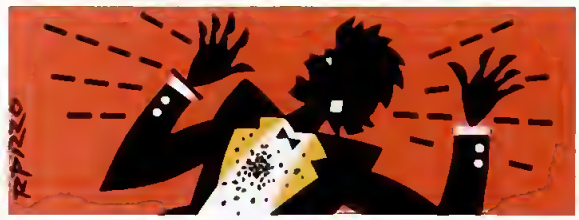
To comply with copyright laws, they had to reverse-engineer the EGA bugs rather than steal them outright.

## And for DIR, just type DEL *.*

The *WordMARC* word processor used PgUp to mean PgDn, Home as PgUp, and the numeric keypad 5 to mean Home.

## Finally, a Laser Printer You Can Wear

Laser printers based on the Ricoh engine may do wonders for your wardrobe (we




hope you like basic black). A good tug on the toner drawer flips it out of the printer and pours toner all over your clothes.

### Copy-Protected Version, $495; Non-Copy-Protected Version, $49,500

Lotus sells unprotected software only to the government and huge companies (in lots of 100 or more).

### The Phil Spector Two-Flops-and-You're-Out Award

To IBM, for unleashing the PC Convertible and the PC-XT Model 286 in the same year. (We're charitably ignoring the RT PC; so's everyone else.)

### We Said Hard, Not Fast

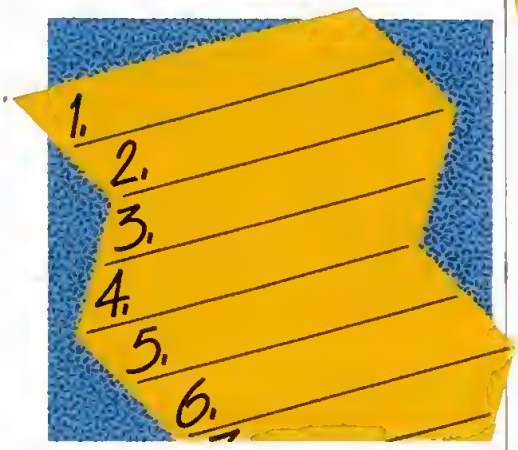
The Toshiba T3100's hard disk, which proves that if you try hard enough, you can create a hard disk that performs like a floppy.

### The Bette Midler Can't-Take-a-Joke Award

To Sandy Schupper of Brown Bag Software: If you're going to sell public domain software, at least sell the most current version. And don't send copy-protected software to people who order the unprotected version.

### PC Magazine Book of Lists, Part 1

Databases released by Borland for *Turbo Lightning:*




### The Manifest Destiny Award

Wells American boasts how it manufactures all the components of its AT right here—even the parts labeled "Made in Korea."

### The Alice in Wonderland Mad Hatter Award

To Ashton-Tate, who copy protected *dBASE III* so it could unprotect the program a year later.

### Deal of the Century, Part 1

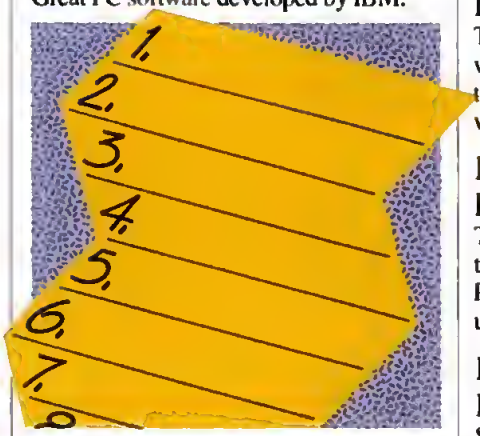
To Zenith for buying the rights to the Morrow Pivot, which they renamed the Zenith Z-171 PC and sold to the IRS for $27 million.

### Deal of the Century, Part 2

To Morrow, who went under right after losing the IRS contract to Zenith.

### PC Magazine Book of Lists, Part 2

Great PC software developed by IBM:




### The Other Envelope, Please

Central Point Software's Michael Brown arrived at the Software Publishers Association convention expecting to receive an award for selling 100,000 copies of his program. The association nixed the award at the last minute when it discovered the program was a disk copier.

### The Other Reader Didn't

Because of a production glitch, a Cauzin Softstrip advertisement in *PC Magazine* contained not only a program listing but the text of an unrelated internal memo. Only one reader caught it.

### Heaven's Gates

Microsoft's long-awaited $134.95 *Technical Reference Encyclopedia* was so full of embarrassing gaffes that it was yanked a week after release.

### Born to ROM

Computerized running shoes tell you distance run, calories burned, and even pulse rate. Several companies are

marketing the $200 marvels, but as a salesman at Runner's World in New York put it, "Nobody buys 'em."

### Makes the PC Convertible Look Good

Tandy's $1,600 Model 600 laptop portable with 32K RAM and a 16-line screen was totally DOS incompatible—and Tandy wondered why nobody bought it.

### Makes the PC Portable Look Good

The Harvard Business School, which used to "strongly suggest" that its students buy PC Portables (R.I.P., 1984–86), now urges them to buy PC Convertibles.

### PC Magazine Book of Lists, Parts 3, 4, 5, and 6

Software that supports the PC Convertible Modem:

Great DOS shells:

RAM-resident software that doesn't want to be loaded last:

Great *Windows* applications:

*Introducing . . .*

# ATI 6/12 MHz System 286

## Specifications:

- IBM PC-AT compatible
- 12 MHz 80286 microprocessor
- Dual speed, 6/12 MHz
- Keyboard switchable
- Norton Sys Info rating of 11.5-13.3
- 1 MByte on board memory
- One 1.2 MByte Floppy Drive
- 200 watt power supply
- AT style keyboard
- BIOS standard

# A Quick Step Forward...

**IT'S FAST!** The ATI System 286-12 runs at an amazing speed of 12MHz. *That's 100% faster than the original IBM Personal Computer AT.®*

**IT'S COMPATIBLE!** Even at this amazing speed, it is compatible with most name-brand multifunction, video and peripheral boards. And to protect your existing investment, we've built-in a normal speed mode as well. A few simple keystrokes will switch you to 6 MHz operation mode, when necessary.

**IT'S RELIABLE!** This ATI system 286-12 is evolved from proven design of ATI-2000 and ATI-1000 mother boards, of which over 10,000 pieces have been shipped in the field. And to back this reputation, on-line technical support is available to you from knowledgeable people who speak your language.

**IT'S VERSATILE!** Combine the ATI System 286-12 with our MegaGraph Plus EGA board to get superb graphics performance. Or expand your system's main memory with the ATI Multifunction card and benefit from Xenix® applications. Up to five disk drive slots and eight expansion slots give you everything you need to grow from single-user environments to the next generation multi-user systems.

Call or write today for more information on our full line of AT® compatible system boards, graphics peripherals, and system accessories. And take a quick step forward!

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CIRCLE 240 ON READER SERVICE CARD

# THE AT CLONE *from* IBM

*The IBM PC-XT Model 286 is a curious mix of assets and drawbacks. With no wait states and a 286 chip, it can outperform some ATs despite its lethargic hard disk.*

New route or dead end? IBM Corp.'s PC-XT Model 286 could be either. Despite its humble XT exterior, the new XT has the power to outrun many ATs. But its $3,995 price tag and slow hard disk could make the machine a tough sell.

Compared to IBM's other personal computers, the XT Model 286 has a lot going for it. It's Big Blue's first 80286 machine with no microprocessor wait states. Its on-board ROM adds significant new identification information and can access a wider variety of hard disks. And the XT Model 286 is genuinely full-featured, with almost no need for expansion. In fact, this computer could make 80286 performance standard for the entire IBM line, and it just may usher in a new generation of personal computers.

Still, the XT Model 286 offers little more than what AT compatibles selling at half the price offer. It sounds like the same old story: IBM introduces a solid, hard-working machine that does not live up to sky-high expectations, particularly those fostered by the introduction of the innovative PC AT nearly 2 years ago. Right now, the XT Model 286 is mainly a curiosity—a possible guidepost to IBM's future direction. As prices inevitably drop, however, it could offer a serious challenge to the compatible makers.

The new XT's familiar gray case hides some big surprises. In fact, as you fire up the Model 286, you might feel the same inward glee as an auto enthusiast who's just fitted a VW Beetle with a Corvette engine: You just itch for some infidel to come around so you can blow his doors off. The new XT will do it.

Although its 80286 microprocessor is throttled down to 6 MHz, the XT Model 286 manages to squeeze out more performance than an AT with an equivalent governor. One bus cycle, which actually determines processing speed, requires 500 nanoseconds on a 6-MHz AT and 375 nanoseconds on an 8-MHz model. The XT Model 286 roars through its bus cycle in 334 nanoseconds. How? IBM has quietly removed the wait states—pauses in processing that hold back the 80286 in the AT—letting the rest of the system keep up with the racy microprocessor.

The actual performance of the XT Model 286 doesn't quite beat that of an 8-MHz AT. For one thing, the newer machine devotes 9 percent of its time to refreshing its memory, versus 5 percent for the AT. (That difference should allow the XT Model 286 to use slower RAM chips.) And, direct memory access (DMA) transfers, which run at one-half clock speed, take longer in the 6-MHz XT Model 286 than in the high-speed AT.

As with the PC AT, the crystal that determines the system clock speed is socketed in the XT Model 286. A casual perusal of the machine's BIOS listing, however, reveals that IBM has imposed an artificial speed limit to prevent hot rodders from changing the crystal and getting more than they pay for from the hardware. After checking the first 64K bytes of RAM and the video section, the new machine compares two internal oscillators, essentially measuring the bus speed with the time-of-day clock. If the bus is too fast, the system won't play.

In the interests of science, I replaced the standard IBM crystal in the XT Model 286 with a higher frequency crystal from a souped-up early AT. When I gave the new system a try, I was greeted by a BIOS-generated error message that brought things to a halt. This result implies that the new XT actually can operate faster than its maker will let it; after all, it could think fast enough to generate the error message. At the very least, you can rest assured that at 6 MHz the XT Model 286 gives your data a wide safety margin (perhaps 50 percent or more), whether you want it or not.

The PC-XT Model 286's BIOS has one other thought-provoking feature. Up to now, IBM has assigned every new PC model its own identification number, a 1-byte code that application programs use to identify the type of computer they're running on. Even when the XT was upgraded with a 256/640K system board, it got its own number. But the Model 286 breaks with that tradition: the hexadecimal number FC, the same code used for the AT, identifies the new XT. A second "series" identification byte (02 for the XT Model 286, 00 for the PC AT) now distinguishes between the two machines. This new scheme suggests that IBM may be considering a whole series of AT-like computers.

*The $3,995 XT Model 286 packs substantial power into the old XT-sized box. The keyboard layout is the 101-key enhanced model with the 12 function keys located along the top.*

**HARD-DISK DOLDRUMS** Aside from a radically updated system board, little has changed inside the new XT's case. In the right rear corner, you'll find the familiar power supply. In the Model 286, however, the chrome-plated box has been upgraded to 157 watts (from 135). It now automatically detects the frequency and the voltage of the power line and sets itself up accordingly. In front of the power supply is a shelf drilled for mounting either half-height or full-height devices in two full-height 5¼-inch disk drive slots.

The standard hard disk is a Japanese-made IBM-brand 20-megabyte unit with a torpid band-stepper head-positioning mechanism that rates among the slowest in creation. IBM rates its average access time at 85 milliseconds, but in my investigation the hard disk was hard pressed to score a laggardly 95 milliseconds. (Compare that with 40 milliseconds or better for the AT's hard disk.) This dilatory disk makes program loading slow and unresponsive compared to that of an AT. It's the new machine's biggest handicap.

The PC-XT Model 286 does not support old-style XT 10-megabyte hard disks. And, surprisingly, the new XT won't even support IBM's own 20- and 30-megabyte high-speed AT hard disks.

Much like the PC AT, the PC-XT Model 286 uses a set-up program and disk parameter table to configure its hard disks. But IBM has broadened the choice of disks that you can plug directly into the system.

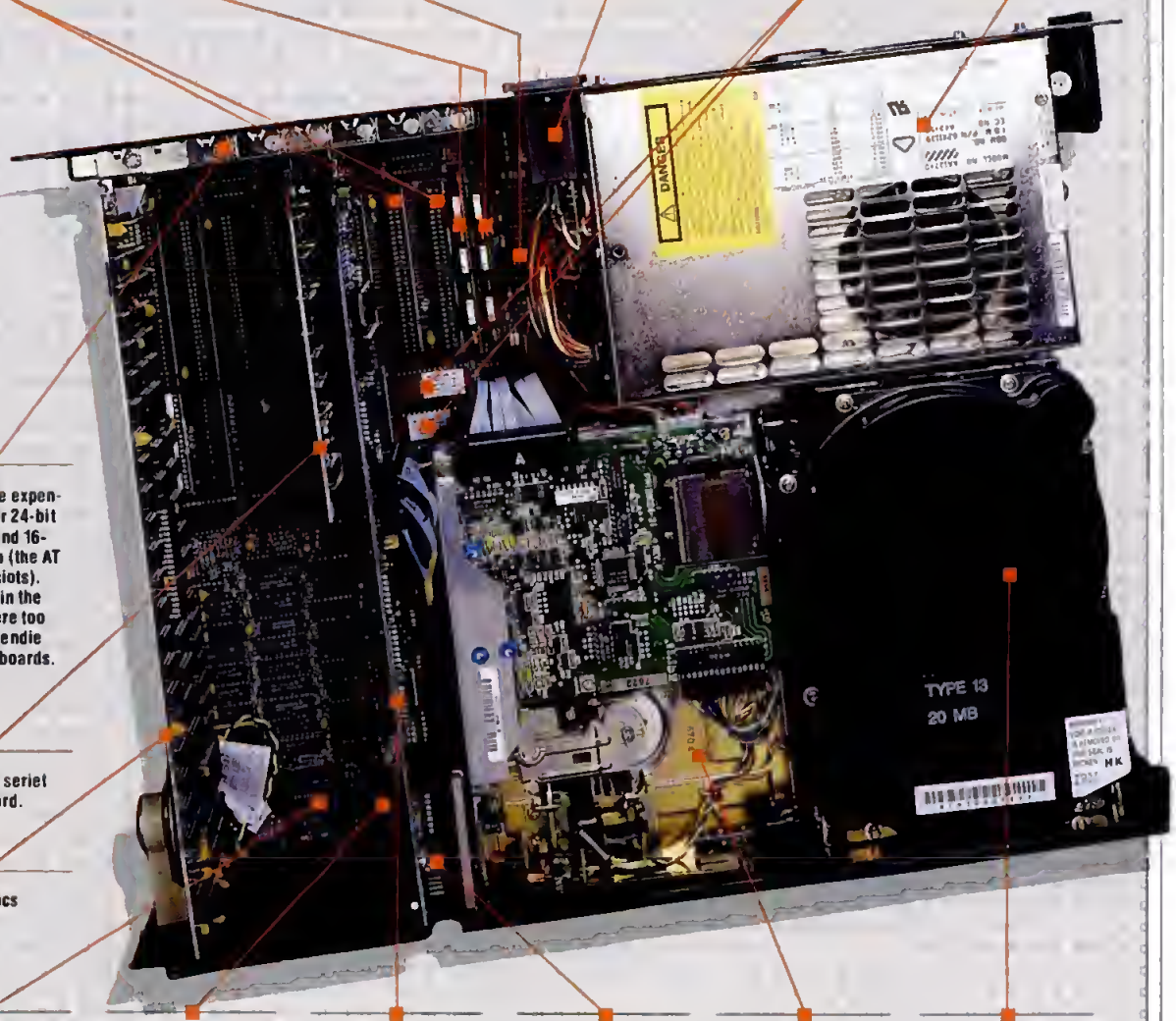
PC MAGAZINE FACT FILE

**IBM PC-XT Model 286**
IBM Corp.
Information Systems Group
900 King St.
Rye Brook, NY 10573
(914) 934-4488
**List Price:** With 640K RAM, 1.2-Mbyte floppy disk drive, 20-Mbyte hard disk, serial/parallel board, keyboard, $3,995.
**Requires:** Monitor and adapter, DOS 3.2.
**In Short:** The original XT upgraded with a heftier power supply and AT-like performance; its main handicap is a slow hard disk.
CIRCLE 699 ON READER SERVICE CARD

Photographs: Vittorio Sartor

# Inside the IBM PC-XT Model 286

The IBM PC-XT Model 286 is a hybrid of older XT and full 16-bit AT technology that IBM hopes will prosper in its particular niche in the personal computer marketplace once its stock of 8088-based XTs is depleted. This inside look at the hardware maps out the machine's XT and AT lineage.




Two expansion slots that can accommodate only very short boards (all AT slots take full-length boards).

256K memory bank with parity (three chips each bank).

128K memory bank with parity (six chips).

Battery for CMOS RAM storing configuration information (same as in the AT).

ROM BIOS.

157-watt power supply (the AT's power supply is 192 watts).

Five AT-style expansion slots for 24-bit addresses and 16-bit data path (the AT has 6 such slots). These slots in the Model 286 are too shallow to handle most 16-bit boards.

Parallel and serial ports standard.

Color/graphics adapter.

Intel 80286-6 microprocessor.

Socket for optional 80287 math coprocessor (partially obscured by board).

Combined hard disk and floppy disk drive controller board.

12-MHz crystal that runs the microprocessor at 6 MHz to the right of silver plate, obscured by the disk controller card. The new AT has 16-MHz crystal.

1.2-megabyte high-density disk drive (like the AT's). Room for another disk drive.

20-megabyte hard disk. Speed is comparable to XT hard disks, not AT hard disks.

By allocating an extra nibble (half a byte) of CMOS memory to store a disk-type setting, IBM has upped the number of predefined drive types from 16 to 24. Potentially, the new system could accommodate 256 head-and-track configurations.

The standard floppy disk drive is a 5¼-inch, half-height, high-density device with 1.2 megabytes of DOS-formatted capacity. It bears the legend "Made in Japan for IBM." In the remaining half-height slot, you can add another high-density drive, a double-sided, double-density (360K) 5¼-inch drive, or a 720K-byte capacity 3½-inch drive. The Model 286 does not, however, support full-height floppy disk drives.

The hard and floppy disk drives run off the same controller card, apparently made by Western Digital Corporation (the onboard VLSI chips bear a WDC copyright). The card can control up to two floppies and two hard disks. The XT card's shorter size appears to be the chief difference between it and the card in the AT.

## Benchmark Tests: IBM PC-XT Model 286 vs. IBM PC AT

On a raw clock speed measurement such as the 128K NOP test, it's obvious that the new PC-XT Model 286 is a 6-MHz machine. However, no-wait-state RAM technology has a significant impact on performance: on the Conventional Memory test, the XT 286 surpassed the 8-MHz AT's speed. Its performance on the BIOS Disk Seek test demonstrates that despite its potential, the XT 286 is crippled by IBM's choice of the standard XT hard disk.

PC Labs decided to run the BIOS Disk Seek test on the XT 286 with a replacement hard disk. Equipped with a fast-access IBM PC AT 30-megabyte hard disk (type 20) and the standard XT 286 controller card, the XT 286 performed at speeds comparable to the 8-MHz AT.

**Performance Times**
(Times given in seconds and decimal seconds)

| | NOP | 8086 Instruction Mix | Conventional Memory | Floating-Point Calculation | BIOS Disk Seek (milliseconds) |
|---|---|---|---|---|---|
| IBM PC AT (6 MHz) | 5.58 | 12.25 | 1.81 | 47.86 | 37.21 |
| IBM PC AT (8 MHz) | 4.17 | 8.96 | 1.32 | 35.60 | 37.19 |
| IBM PC-XT Model 286 (8 MHz) | 5.55 | 9.61 | 1.27 | 38.06 | 96.28 |

**PLAYING BIG CHIPS** The full 16-bit AT-style data bus is used in five of the new XT's expansion slots; except for height, the slots are fully AT compatible. Both short slots and slot 1 (the leftmost one, viewed from the front) remain 8-bit only. The rest of the system board is remarkable for its absence of empty sockets. There is space for an 80287 math coprocessor (ordinary 8087s are verboten). You won't find room for memory expansion or for additional ROM modules.

In the PC-XT Model 286, IBM seems finally to have acknowledged the fact that the full 640K-byte memory endowment is mandatory, particularly with a personal computer this powerful. That memory complement resides in several proprietary chips banked together in two memory modules. Like all the full-size IBM personal computers, the RAM is parity checked.

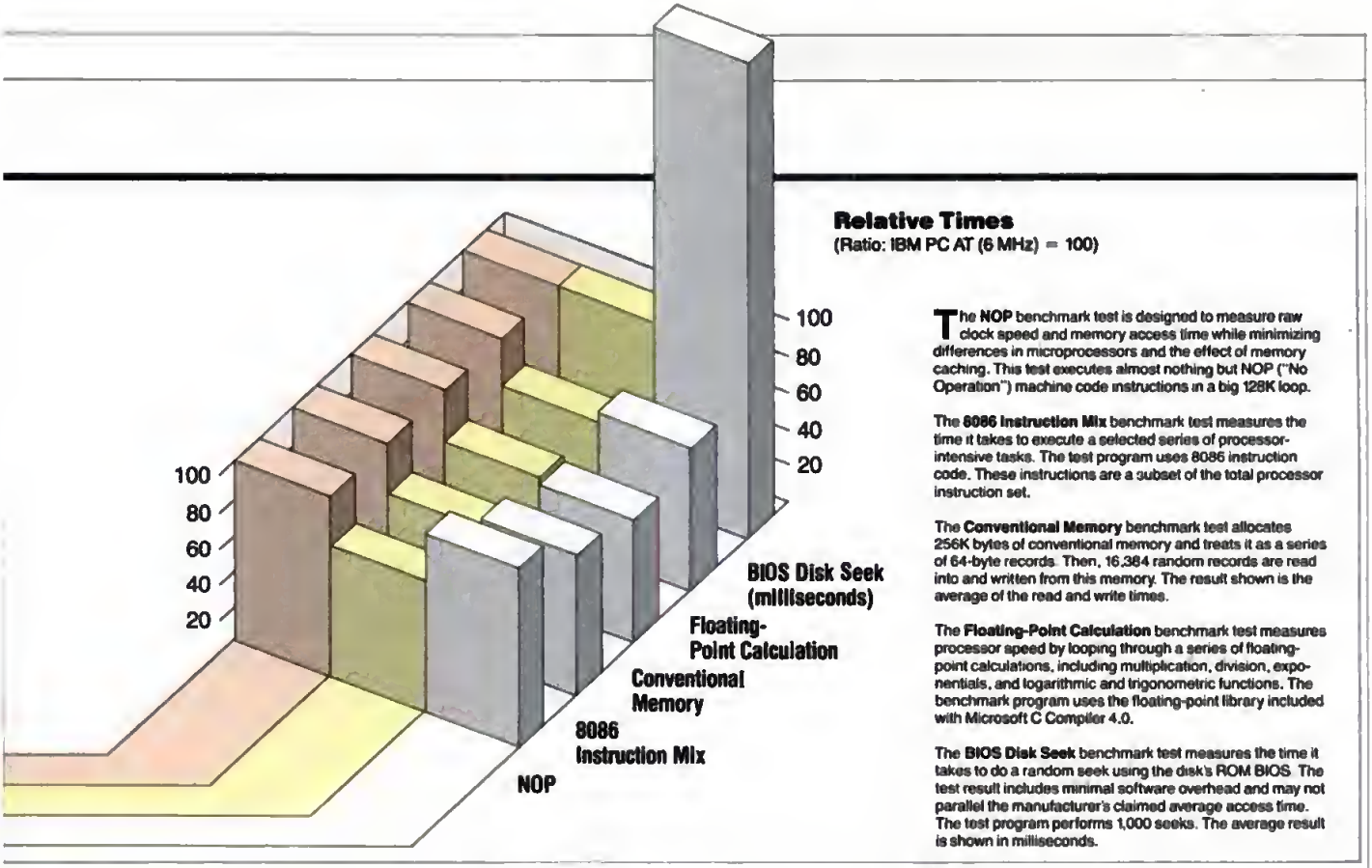
One of the memory modules is rated at 512K bytes and consists of six shiny metal cans on two tiny daughtercards plugged into the system board. Although the cans are labeled only with proprietary (and thus indecipherable) IBM nomenclature, simple math indicates that each must contain at least 768K bits, either as three separate 256K-bit chips or as a larger, monolithic chunk of memory. In fact, it's possible that the PC-XT Model 286 is the first PC to use full-megabit RAM chips.

The remaining 128K bytes of memory are arranged just as unconventionally, using four 64K-bit by 4-bit chips and two 256K-bit RAM chips soldered to the system board. The 4-bit-wide chips are used in pairs for byte-size storage, and the 256K-bit chips handle parity checking. For compatibility with some expansion products, the 128K-byte bank of RAM can be switched off with a jumper. Also, because that board already reaches the full DOS memory limit, the proprietary chips-and-memory arrangement poses no expansion problems (unlike the first AT's piggybacked 128K RAM modules, which had limited sources of supply).

Those who need expanded memory or protected-mode memory can install additional RAM in the expansion slots as soon as XT-size cards that can take advantage of the new machine's 16-bit performance become available. IBM is ambiguous about the actual memory limit in the Model 286: its press materials state that top capacity is 12.6 megabytes, but its Technical Reference manual allows for 15 megabytes. Presumably, IBM's own memory expansion products impose the lower limit, while more densely populated cards should permit the higher number.

Like the AT, the XT Model 286 has a built-in clock, backed up by a lithium battery. Because its plastic holder protrudes slightly from the back of the system unit, the battery can be replaced without prying off the computer's lid. The 6-volt battery, a Panasonic-type BR-E2, has an estimated life of several years; IBM offers a replacement for $8.95.

Standard equipment also includes a special new combined serial/parallel port adapter card. (The AT serial/parallel adapter is not compatible.) The parallel port uses the IBM-style female DB-25 connector and can be configured as LPT1 or LPT2 in systems without monochrome display adapters, or as LPT2 or LPT3 in systems with monochrome adapters. The serial port uses an AT-style male DB-9 connector and can be configured as either COM1 or COM2. Based on the 16450 Universal Asynchronous Receiver/Transmitter (UART) chip, the serial port will communicate as a data terminal (DTE) device at speeds between 50 and 9,600 bits per second. Like all previous IBM asynchronous communications adapters, it is




The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentials, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

wholly software configurable.

The keyboard shipped with the PC-XT Model 286 is the 101-key enhanced model, now a standard across IBM's PC line. The Esc key is located in the upper left, 12 function keys line the top margin, and a T-shaped cursor pad and other control keys separate the alphabet keys from the numeric keypad. The feel is standard IBM, though a bit tighter and thinner-sounding than that of the older models.

**BOARD ROOM** A flurry of bad press followed the first time someone actually took the lid off a PC-XT Model 286, slipped in an expansion card, and tried to close the unit. Actually, it's amazing the attempt was made at all; the size difference between XT and AT expansion cards should be obvious to anyone.

Yes, a PC-XT Model 286 expansion card is about three-quarters of an inch shorter than the typical AT expansion card. AT cards work in the XT Model 286 because the two machines are completely bus-compatible. However, you can't put the lid back on the shorter machine once you've lined its insides with the taller cards. Cards that won't fit include all IBM PC AT memory expansion boards, the AT Prototype Card, and the Professional Graphics Adapter.

In theory, the size differential has astounding ramifications. Expansion product makers will have to spend millions of dollars and endure endless retooling to make their products fit yet another (shudder) IBM standard.

In reality, I can't see why anyone cares. Nearly every expansion card designed exclusively for the AT falls into one of two classes: multifunction boards and multiport cards. Most people will never need one of the current generation of add-on memory boards in a PC-XT Model 286 because it already has a full endowment of DOS memory. High memory, while intriguing, is not yet useful for genuine personal computer applications except RAM-disks, and the few Lotus/Intel/Microsoft expanded memory specification (EMS) programs. Someday it *will* be useful, of course, but by then, smaller 16-bit bus memory boards will be available.

Even less worrisome is the incompatibility of 16-bit multiport cards. Those products make sense only for multiuser systems with non-DOS operating systems or in computer-aided manufacturing and process control applications. If you look at the PC-XT Model 286 as a *personal* computer—used by one person—it doesn't need them.

And don't fret about the incompatibility of AT combined floppy and hard disk controller cards, because a reduced-height 16-bit bus card comes as standard equipment in the PC-XT Model 286. The other big class of expansion cards you're likely to want—monitor adapters—already fit. They have for years.

The PC-XT Model 286 is also incompatible with some IBM Token Ring Network Adapters—a fact that was noted at the machine's introduction but that still took some industry people by surprise when they tried to use the adapters in the machine. IBM has updated the adapter to ensure compatibility between the network and the new XT.

There are a few other cards that will work in the XT Model 286, though IBM doesn't officially support their use in the machine. These include eight-bit memory cards, drive adapters, and the IBM game control adapter.

**LEMON OR LANDMARK?** Is the IBM PC-XT Model 286 an AT in an XT box, an upgraded XT, or a clone-killer? The an-

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## ■ PC-XT MODEL 286

swer is that it's really a bit of all three, and more: IBM's first full 16-bit *personal* computer. Certainly other IBM machines, like the AT, have boasted 16-bit data buses. But I believe that the AT was designed to serve as a shared system and a network anchor. Although the speed maniacs grabbed it up, the AT was meant not for the many, but for the few.

After 5 years, the PC has graduated to full 16-bit architecture. Although I was a bit surprised to find the new PC in the same old box, I think that IBM probably wanted to maintain continuity and stave off any comparisons to the unlamented PC*jr*. Using the old shell also saves the slightly strapped company a few bucks in tooling. And it provokes an intriguing question: Will IBM offer the system board alone to current XT owners so that they will be able to upgrade to AT performance?

From IBM's perspective, the PC-XT Model 286 is a tactical rather than strategic product. As a lower-priced AT, this new machine fits nicely into the product mix. IBM can sell off its 8-bit machines, have a (slightly) lower-priced entrée into the 16-bit world, and gradually phase in the expectation of a fivefold performance increase. Once it sells off the remainder of the old technology, IBM can slash the price of the PC-XT Model 286 and give the clone-makers a good run for the money.

That kind of plan makes sense, because the new XT is not much more expensive to manufacture than the old one. The major difference is a handful of slightly more expensive chips, and when you buy in the quantities that IBM does, that premium can be awfully small. The new machine's high price seems to be IBM's insurance against the Osborne effect: getting stuck with a warehouse full of old technology that can be sold only at a big loss.

At $3,995, the PC-XT Model 286 is no bargain. Conceivably, however, it might compete successfully at the $1,500 price point of the AT clones—at least as soon as the stocks of 8088-based XTs are depleted. Marked down to the price of the standard XT, the newer model could offer unusually good value for a computer bearing the IBM nameplate. PC

*Winn L. Rosch is a contributing editor of* PC Magazine.

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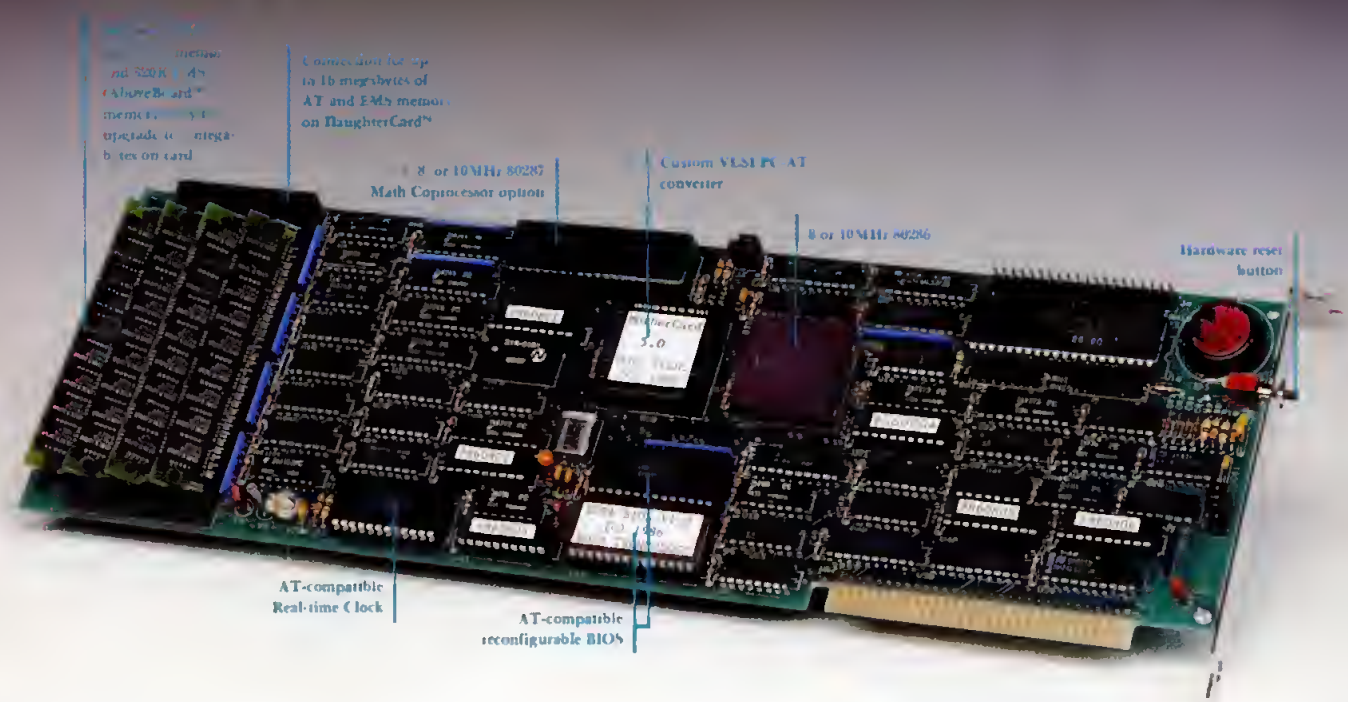


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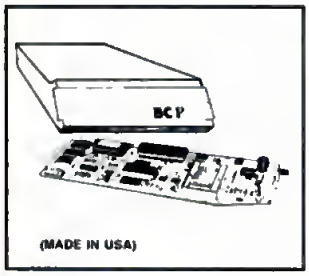


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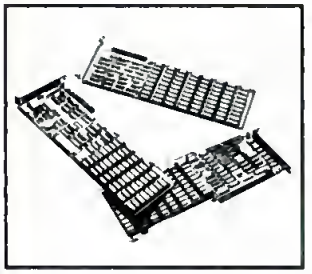

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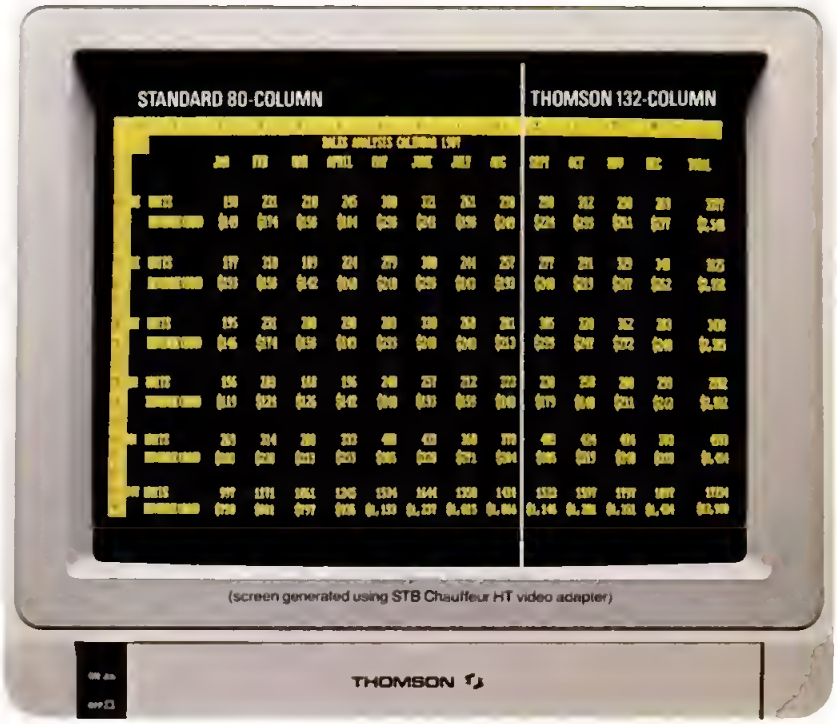


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# Stretching The Standard: Seven New EGA Boards

*New enhanced graphics adapters forge ahead of their IBM progenitor, offering EGA and higher-than-EGA resolution video modes, plus multiple compatibility schemes.*

In the 5 months since our first survey of enhanced graphics adapters ("Achieving the Standard: 12 EGA Boards," *PC Magazine*, Volume 5 Number 14), the EGA has become commonplace almost to the point of boredom. That's not a complaint, it's a compliment. The credit for the EGA proliferation belongs largely to Chips and Technologies (CTI), whose low-priced, four-piece EGA CHIPSet allows hardware manufacturers to assemble and sell EGA boards at a fraction of the cost of IBM's original. Virtually every XT and AT clone that passes through the PC Labs comes with its own EGA board based on the CHIPSet; some have EGA implementations on their system boards.

Meanwhile, more-adventurous hardware manufacturers have been sowing the seeds of innovation, and we examine here the fruits of their labor. They are at the cutting edge of EGA development, where boards not only mimic the IBM original but add higher-resolution video modes, achieve close compatibility with the IBM Color/Graphics Adapter and the Hercules Graphics Card, and include some unique software features. In 5 months, the EGA has bloomed into many different flowers.

**MORE DOTS** Advances in video mean advances in resolution. IBM's Enhanced Graphics Adapter can achieve maximum resolution of 640 dots horizontally by 350 scan lines vertically. Three of the EGA compatibles reviewed here surpass that, with additional video modes as high as 640 by 480—sometimes (rather deceptively) called PGC resolution. The IBM Professional Graphics Controller came on the scene at around the same time as the Enhanced Graphics Adapter, but it's a completely different board: it has an analog output (requiring a monitor such as IBM's Professional Graphics Display) and is capable of 256 different colors from a palette of 4,096. By contrast, the EGA's TTL (transistor-transistor logic) output can display only 16 simultaneous colors from a palette of 64.

For certain applications, a 640- by 480-pixel display yields an interesting dividend. Most small monitors have a displayable area of about 240 by 180 millimeters. Divide the width by 640 dots and the height by 480 dots, and you'll find that the horizontal and vertical resolutions are identical. Creating a box that's 100 by 100 pixels will thus be square, that's a nice convenience for programmers writing their own graphics routines. For anybody else, it's merely a coincidence.

**STUBBORN DISPLAY** Unfortunately, increasing vertical resolution from 350 to 480 doesn't come easy—and that's the monitor's fault. Regardless of the adapter you use, IBM's Enhanced Color Display will not show more than 350 scan lines per screen.

Most monitors are locked into specific vertical and horizontal frequencies, sometimes called sync rates, that determine the maximum number of displayable scan lines. The vertical frequency is the rate at which the whole screen is refreshed (about 60 Hz for most monitors). The horizontal frequency is the rate at which each scan line is displayed. So, dividing the horizontal frequency by the vertical frequency gives you the number of scan lines (including some for retrace and for the top and bottom borders). The video adapter must provide horizontal and vertical sync signals at these two frequencies, with very little deviation. The monitor thus limits the adapter to a certain number of scan lines and effectively constrains vertical resolution, no matter what the video board theoretically can do.

Increasing horizontal resolution is not nearly as troublesome because it doesn't involve critical synchronization frequencies. You can easily increase the adapter's dot clock frequency without affecting the horizontal sync frequency, thereby increasing the horizontal resolution without running into any problems. The number of horizontal dots per scan line equals the adapter's dot clock frequency divided by the horizontal frequency. The monitor's

bandwidth rating theoretically limits the dot clock frequency, but the bandwidth is a conservative rating and can generally be exceeded.

As a matter of fact, built right into IBM's EGA specification is the selection of an alternate crystal for the EGA's dot clock. From there, it's just a matter of loading different values into the CRT controller registers on the EGA board. (Do-it-yourselfers should consult the sidebar "Using the EGA Feature Connector for a 120-Column Display," *PC Magazine*, Volume 5 Number 15, page 298, to see how easy it really is.) An EGA manufacturer using a similar technique can stretch out horizontal resolution by 50 percent. IBM's original Color Display operates at standard television sync rates: a vertical frequency of 60 Hz and a horizontal frequency of 15.75 KHz. The number of scan lines is 262, but the IBM Color/Graphics Adapter uses only 200 for the display area. The CGA dot clock is 14.32 MHz. IBM's Enhanced Color Display, with the same vertical frequency, can operate at two horizontal frequencies: 15.75 KHz for compatibility with the Color Display and 21.85 KHz for 350 scan lines. In the 350-scan-line modes, the dot clock is 16.257 MHz. (The monitor senses which mode to switch to by the polarity of the horizontal sync frequency.)

**MULTISYNC TO THE RESCUE** What do you do if you want more than 350 scan lines per screen? Go out and buy the NEC JC-1401P3A MultiSync monitor (reviewed in "The EGA Standard: Monitors That Measure Up," *PC Magazine*, Volume 5 Number 6). The NEC MultiSync can adjust automatically to a continuous range of horizontal frequencies from 15.75 KHz (the CGA) to 30 KHz (more resolution than the EGA). So, with its vertical frequency of 60 Hz, the MultiSync can display anything between 200 and 500 scan lines. In fact, it's actually rated for 560 lines maximum.

The NEC MultiSync has proved to be quite popular as an EGA monitor. Perhaps buyers of the MultiSync believed they were making an investment in the future—and so they were. Now, with newer, smarter video boards on the market, they can start cashing in.

## VEGA Deluxe and QuadEGA ProSync

In our first look at EGA boards, we ranked Video-7's VEGA board (also sold by Quadram Corp. as the QuadEGA+) as a standard CTI implementation with a hardware problem and a messy CGA and Hercules emulation scheme. But an improved model has since appeared. The upgraded VEGA Deluxe and QuadEGA ProSync (again the same board) boards include two new graphics modes, 640 by 480 and 752 by 410, both requiring a NEC MultiSync or equivalent.

The VEGA Deluxe has a mere 20 chips—very economical, considering that this includes the four CTI chips, eight memory chips, and a ROM BIOS. Except for the socketed ROM, everything is surface-mounted. The board includes the normal 16.257-MHz crystal and a 24-MHz crystal for the higher-resolution modes. Video-7 chose to wire the 24-MHz crystal as if it were an external clock source coming from the feature connector (that's not the only way to do it). If you want to attach a real feature connector to the board, you'll have to disable the 24-MHz crystal by switching a jumper.

**SQUASHED WINDOWS** At the moment, the software support for this board's higher-resolution modes is limited to *Microsoft Windows*. But if you don't have *Windows*, don't worry: Video-7's package includes *Windows* (Version 1.03), and Quadram gives you a card to get the program for $30. Video-7 is also working on Lotus drivers.

If you're accustomed to using *Windows* on an EGA, it may look a little squashed in the 480-line mode, which uses the same fonts and the same pixel resolution for icons and cursors as does the 350-line EGA. In theory, Video-7 should have provided new fonts designed specifically for the display resolution. You may prefer not having these new fonts anyway, because the regular EGA fonts bring more than 35 percent more character lines into view. And, as a nice proof of *Windows*' device-independent graphics interface, properly designed *Windows* applications that need to draw perfect circles and work in absolute measurements (such as Micrografx's *DRAW!*) adjust to the new resolution with no problem.

Someday, perhaps, a hardware manufacturer will need to provide only a new *Windows* driver with each new piece of hardware. Today, however, Video-7's software support for its new video modes must be characterized as weak. Although the VEGA Deluxe BIOS includes a "hook" for these new video modes, you can't switch to them using the standard BIOS calls: that would have threatened to conflict with future IBM video modes. Video-7 will make available small assembly language routines designed to get at the new graphics modes, for software developers and (as a Video-7 engineer told me) for "anybody who sounds like he knows what he's doing."

I like this board and I like the *Windows* drivers, but I don't like the misleading box they come in. People who have explored how *Microsoft Windows* uses the EGA have found that *Windows* uses only 8 of the 16 colors available in high-resolution graphics modes. The program then mimics

PC MAGAZINE FACT FILE

**VEGA Deluxe**
Video-7 Inc.
550 Sycamore Dr.
Milpitas, CA 95035
(800) 238-0101
(800) 962-5700 (in Calif.)
**List Price:** $599
**Requires:** The NEC MultiSync monitor for extra video modes.
**In Short:** The included *Windows* drivers for 640 by 480 and 752 by 410 graphics modes make the VEGA Deluxe a good board for the *Microsoft Windows* user. *Windows*, Version 1.03, is also included.
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**QuadEGA ProSync**
Quadram Corp.
One Quad Way
Norcross, GA 30093
(404) 923-6666
**List Price:** $595
**Requires:** The NEC MultiSync monitor for extra video modes.
**In Short:** Identical to Video-7's VEGA Deluxe, the QuadEGA ProSync includes the *Windows* drivers but only a discount card for *Windows* itself.
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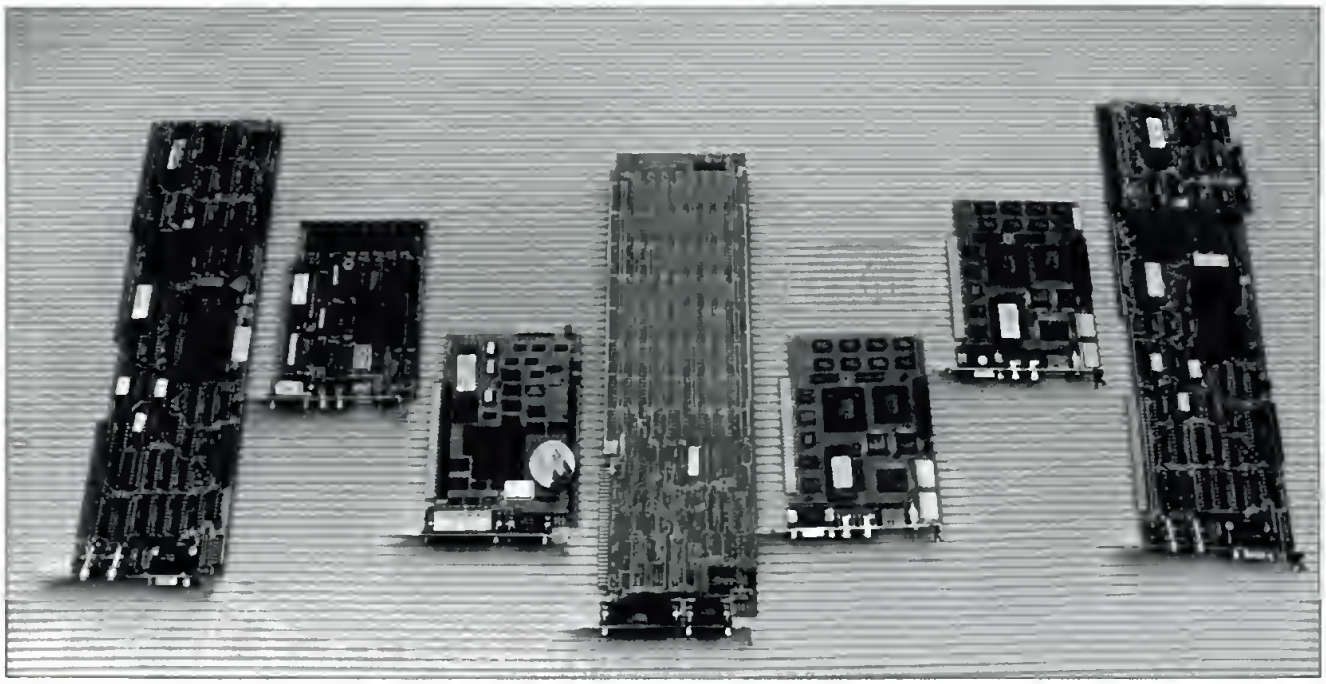

*(Left to right) Tseng Labs developed its own EGA chips for both the Eva (far right) and the Eva/480; the Paradise AutoSwitch lets you switch to a CGA emulation that survives a reboot; IDEAssociates' Overboard has a composite video output jack, while its All Aboard includes 2 megabytes of Lotus/Intel/Microsoft expanded memory; the VEGA Deluxe and QuadEGA ProSync have 640 by 480 and 752 by 410 graphics modes.*

Photograph: Thom O'Connor

more than 256,000 additional colors by dithering, or combining pixels of the 8 colors to look, at a distance, like more. *Windows* uses only 8 colors because this best fits its encoding of separate red, green, and blue values. Using 1 bit for each, as is done on the EGA, yields 8 colors. Two bits each for red, green, and blue requires 64 colors, something beyond EGA capabilities.

Some *Windows* users have complained that the program doesn't take full advantage of the EGA's 16 colors. So the VEGA Deluxe box, which pictures two *Windows* displays and indicates that they show 16 colors, might kindle some false hopes. Sorry, the drivers still use only eight.

As with the earlier versions, the VEGA Deluxe and QuadEGA ProSync implement CGA and Hercules emulation through a small resident program. When a program uses one of the CGA or Hercules registers not supported by the EGA, the board generates a nonmaskable interrupt (NMI) that the resident program picks up and attempts to deal with. The NMI has led a terrible life from the very beginning of the PC, when IBM chose to use it for signaling memory parity errors, later compounding the problem by also using it for the math coprocessor exception interrupt and then in a debugging package. Now it's a free-for-all; anybody who needs an interrupt picks the NMI. (The extent of the problem will become clearer in my discussion of the Paradise AutoSwitch board.)

**COPYING THE BUGS** Achieving total IBM compatibility in an EGA board gives a manufacturer the delicate task of duplicating the IBM BIOS bugs without much tampering. If an EGA-compatible manufacturer minimally deviates from IBM's design, and a software manufacturer slightly misinterprets IBM's specifications for using the EGA BIOS, the hardware and software could collide.

That happened with Video-7's VEGA Deluxe and Microsoft's new CodeView debugger (included with its C 4.0 compiler). With the VEGA Deluxe installed, the debugger pops up to the screen in garish magenta letters on a green background. Even worse: after a little use, the foreground disappears. You can't read the menu, though you can still select things from it. Fortunately, Microsoft has a patch. Video-7 got a lesson on rule number 1: don't try to fix IBM's bugs.

## Eva and Eva/480

Tseng Laboratories, well known in video, is one of the few manufacturers willing to develop its own EGA chips rather than using Chips and Technologies' EGA CHIP-Set. The Tseng Labs ET2000-Series Chip

*(continues)*

PC MAGAZINE FACT FILE

**Eva**
Tseng Laboratories Inc.
Newtown Industrial Commons
205 Pheasant Run
Newtown, PA 18940
(215) 968-0502
**List Price:** $499 ($50 more for CMII compatibility module).
**In Short.** *1-2-3* and *Symphony* users can stretch their screens with the included 132-column drivers. A BIOS interface to the additional video modes allows easy programmer access.

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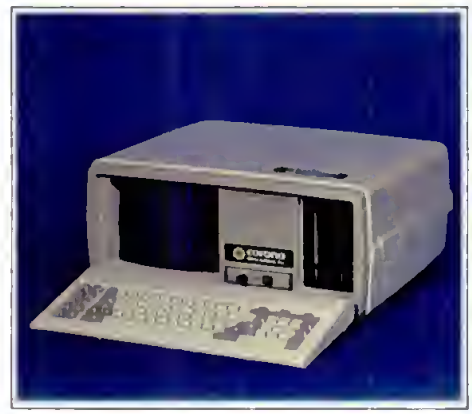

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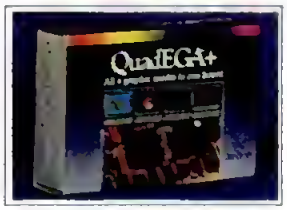

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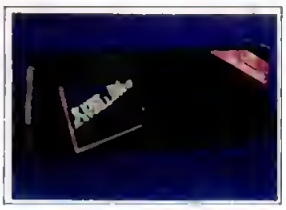

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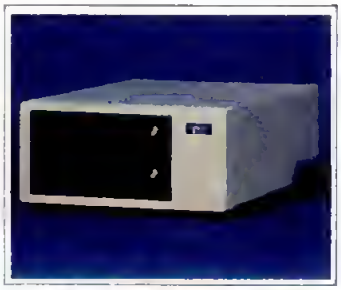

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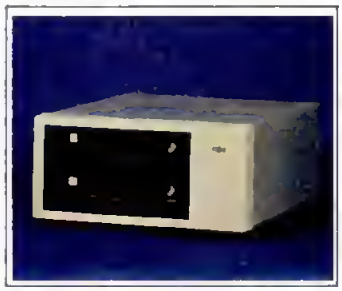

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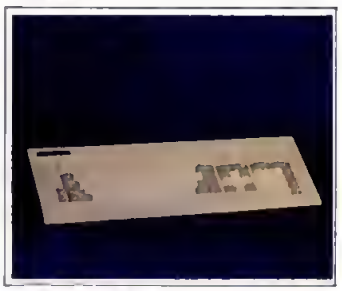

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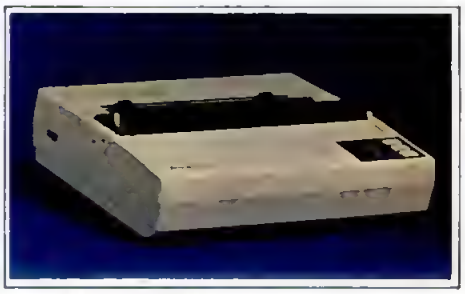

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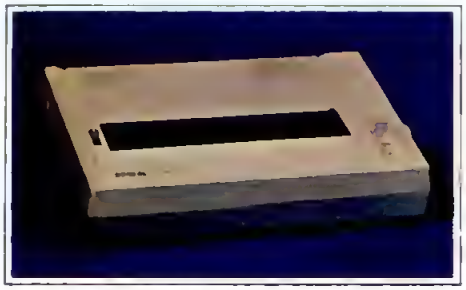

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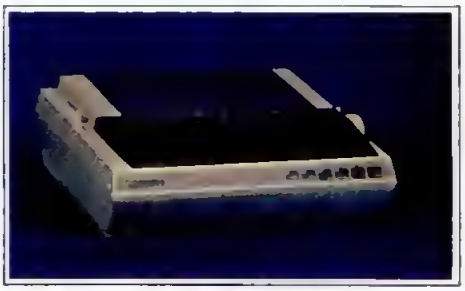

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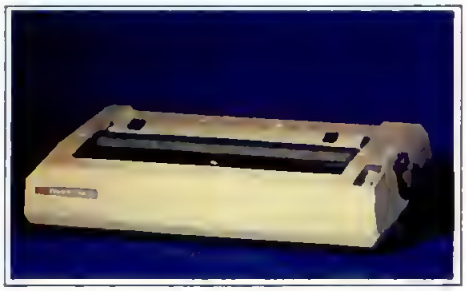

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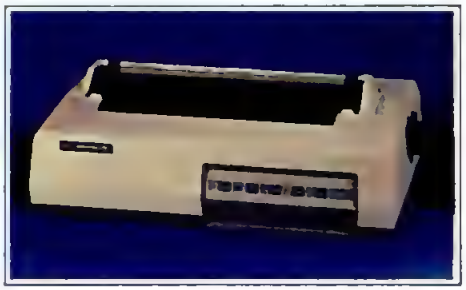

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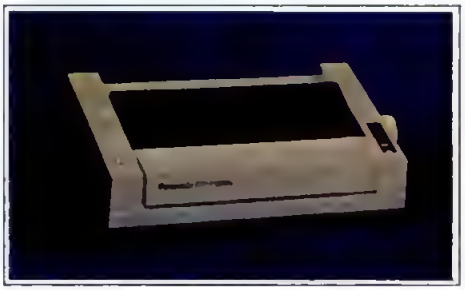

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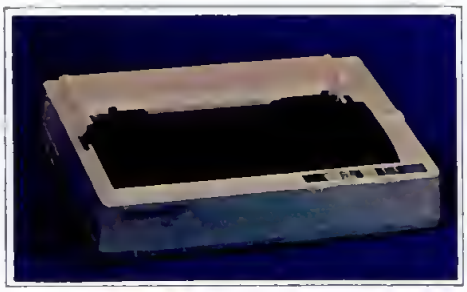

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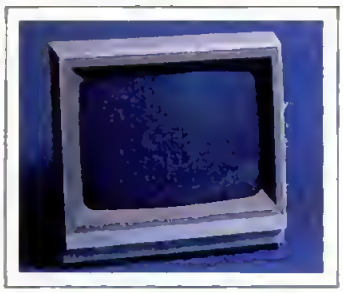

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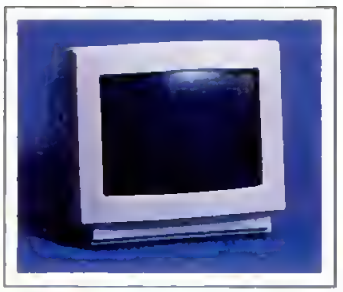

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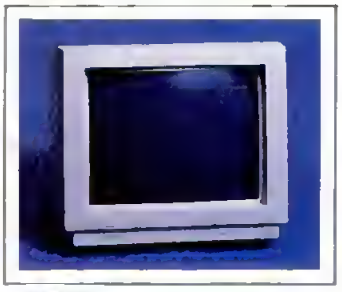

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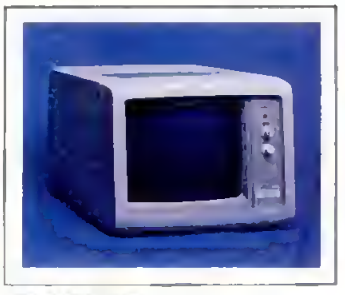

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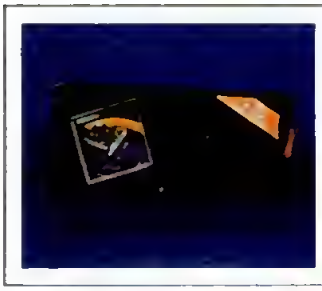

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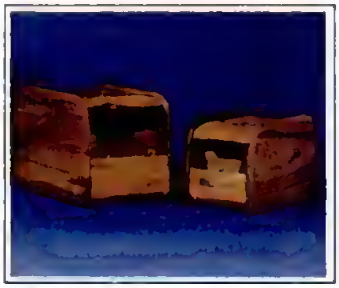

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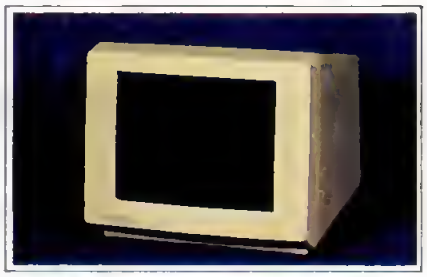

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**BRAVE OR CRAZY?** In an age of paranoically strict IBM compatibility, Tseng Labs has brazenly added features to the EGA. The ET2000-Series can provide fonts that are 6, 8, 9, 12, and 16 dots wide (IBM's EGA does only 8 and 9), along with a hardware zoom that blows up the pixels in a window by integral multiples up to 8 times wide and 16 times high.

Tseng Labs added these features mostly using the same set of output ports found on IBM's EGA and compatibles. These ports are indexed; that is, software writes to a specific register by first writing an index number to the port, followed by the value for that register. On the IBM board, the CRT controller registers have indexes ranging from 0 to 26. The Tseng Labs chip duplicates these and then has unique registers starting at index 27.

In choosing such a path, Tseng Labs has taken a brave step—or, if you prefer, a crazy one. For example, what if IBM decides to release a "super EGA" that uses these same registers for other purposes?

**NEW MODES, GOOD SUPPORT** Both the Eva and Eva/480 boards add three video modes that may be used with an IBM Enhanced Color Display or any compatible. These three are character modes: 132 columns by 25 lines, 132 columns by 28 lines, and 132 columns by 44 lines. (The additional character lines are made possible by using smaller fonts.) The Eva/480 includes two more video modes, a 640- by 480-pixel graphics mode and an 80-column by 60-line text mode, both requiring a NEC MultiSync or compatible.

Software support includes *1-2-3*, Release 2.0, and *Symphony*, Version 1.1, drivers for all the 132-column modes, a replacement version of ANSI.SYS (called EANSI.SYS) that supports all the new modes, and a font editor and loader. The Eva/480 includes a 640- by 480-pixel driver for *Windows* and a copy of *Dr. HALO II* with drivers for the Eva and Eva/480. An Eva/480 driver exists for *AutoCAD*, too. That's a nice collection of software.

Tseng Labs has also made the additional video modes easy for programmers to use, once again in a brave-or-crazy way. The company has assigned video mode numbers from 34 to 38 for its additional video modes. A program can switch to these video modes simply by calling the interrupt 10h "Set Mode" call—as easy as switching to any of the IBM-defined video modes. A mode-switching program comes with both Eva boards, so you can enjoy these modes right on the DOS-command level. However, what if IBM decides to use these mode numbers for something else? In this game, the winner isn't necessarily the one who gets there first.

The CMII module (an option for the Eva and included with the Eva/480) manages CGA and Hercules compatibility. The module attaches to the full-length card as a daughterboard and uses a Z-80 microprocessor. You turn compatibility mode on and off with a pair of programs called CMON and CMOFF. The CGA emulation is much better than any I've seen on a Chips and Technologies' EGA implementation.

Still, the Eva BIOS is faulty in spots. The logic for the interrupt 10h "Write String" call is not correct, and the "Read Dot" call crashes in the 350-line modes. Although graphics programs don't often use the Read Dot routine, screen-print programs do. Late in the testing, Tseng Labs delivered two new BIOS chips for the Eva and Eva/480 boards dated October 13, 1986. These new chips corrected the Write String logic and didn't crash on Read Dot calls. However, the Read Dot BIOS call returned incorrect color values.

The *Microsoft Windows* driver included with the Eva/480 board worked fine in 640- by 480-pixel mode. On closer examination, however, it had a little flaw that really bugged me. *Windows* applications can get information about the device used for the display through a function called "GetDeviceCaps," which means to get device capabilities. Among other things, this function returns information about the physical size of the display area, the horizontal and vertical resolution, and the relative horizontal and vertical pixel size. The latter should have been reported as equal in 640- by 480-pixel mode, but they were not—they were the same values reported by a normal 640- by 350-pixel *Windows* EGA driver.

## Paradise AutoSwitch

Like Tseng Laboratories, Paradise Systems has developed its own EGA chip, called the PEGA, which the company has put on its AutoSwitch EGA board. The

### PC MAGAZINE EDITOR'S CHOICE

*Retaining compatibility with IBM and offering added value have to be tough for EGA manufacturers. Tseng Laboratories' Eva/480 takes some risks with future IBM compatibility but delivers easy-to-use 132-column text modes and 480-scan-line graphics modes with a nice collection of software support.*

*If the Tseng Labs' board intrudes too much on IBM's territory for your comfort (it does for mine), you'll be happier with Video-7's VEGA Deluxe or Quadram Corp.'s Quad-EGA ProSync. The Chips and Technologies' EGA CHIPSet is well established and the Video-7 BIOS is nearly rock-solid.*

*At a list price of $395, the EGA Master from Tecmar, which was the Editor's Choice in "Achieving the Standard: 12 EGA Boards" (PC Magazine, Volume 5 Number 14) remains a good value.*

### PC MAGAZINE FACT FILE

**Eva/480**
Tseng Laboratories Inc.
Newtown Industrial Commons
205 Pheasant Run
Newtown, PA 18940
(215) 968-0502
**List Price:** $680
**Requires:** The NEC MultiSync monitor for higher-vertical-resolution video modes.
**In Short:** A 640 by 480 graphics mode and an 80- by 60-character mode add extra value to the already feature-laden Eva. A *Windows* driver is included and an *AutoCAD* driver is available.

CIRCLE 624 ON READER SERVICE CARD

board's EGA implementation is fine; the only real problem I found was messy horizontal pixel panning. In addition, the Paradise AutoSwitch provides very good CGA, Hercules, and Plantronics compatibility. (At the time of this writing, Paradise Systems had just announced the PEGA 2, a 480-scan-line version of its chip. By the time you read this, the company will probably have a board that uses it.)

The neat thing about the Paradise board is that it can switch into one of the compatibility modes without any external software. If a program starts to treat the Paradise AutoSwitch as if it were a CGA, the AutoSwitch board will switch to CGA compatibility mode. Thus, the AutoSwitch offers a convenience not found in the other EGAs. They require either a resident program that intercepts nonmaskable interrupts (NMIs), such as Video-7's VEGA Deluxe, or a utility that switches to a compatibility mode, such as Tseng Labs' Eva).

**NMI—AGAIN** How does the AutoSwitch do it? Like Video-7's VEGA boards, the AutoSwitch generates a nonmaskable interrupt when an applications program writes to one of the registers not defined by the EGA. Unlike the VEGA's, this board's NMI is not intercepted by a resident program but by a routine in the AutoSwitch BIOS. That routine then does what the VEGA resident program would do—it either ignores the attempted operation or translates it into something an EGA can understand.

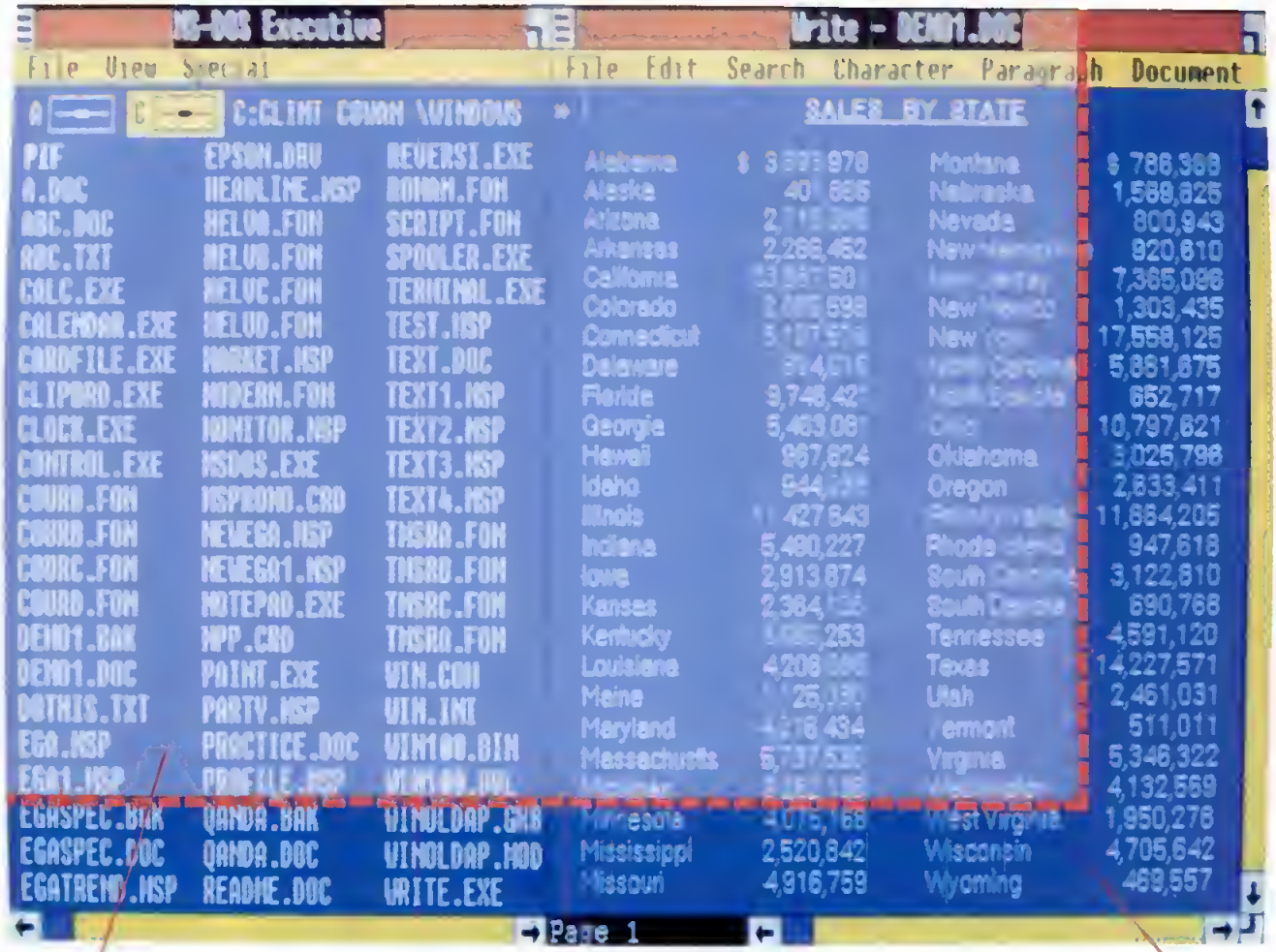
You can turn off auto-switching by using a DIP switch, accessible from the back. The manual advises that you leave it off if you have a second adapter installed,

## EGA Boards: Summary of Features

| Product/ Manufacturer | List Price | Extras | Warranty | Software | Card length | Chip count | Graphics chip | Additional video modes | Emulation* | BIOS copyright | BIOS: Version (or date tested) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Eva** Tseng Laboratories Inc. | $499 | CMII emulation module†, parallel printer port | 1 year | Emulation, ANSI driver, mode changer, font utility, Lotus's *1-2-3*, and *Symphony* drivers | Full | 49 (11 on CMII) | Tseng Laboratories ET2000 Series | 132 × 25 text<br>132 × 28 text<br>132 × 44 text | CGA, HGC (with CMII module) | Tseng Laboratories | 10/13/86 |
| **Overboard** IDEAssociates Inc. | $595 | Parallel port, serial port, composite video output, clock | 1 year | Installation, clock software | Half | 67 | NSI Logic | None | CGA, MDA | NSI Logic | 10/13/85 |
| PC **QuadEGA ProSync** Quadram Corp. | $595 | *Windows* discount, 640 × 480 and 752 × 410 graphics modes | 2 years | Emulation, diagnostics, palette utility, *Windows* drivers | Half | 20 | Chips and Technologies EGA CHIPSet | 640 × 480 graphics‡<br>752 × 410 graphics‡ | CGA, HGC | Video-7 | 1.06 |
| **Paradise AutoSwitch** Paradise Systems Inc. | $599 | None | 1 year | Emulation | Half | 31 | Paradise PEGA I | None | CGA, HGC, and Plantronics | Paradise Systems | 1.40 |
| PC **VEGA Deluxe** Video-7 Inc | $599 | *Windows* 1.03 | 2 years | Emulation, diagnostics, palette utility, *Windows* drivers | Half | 20 | Chips and Technologies EGA CHIPSet | 640 × 480 graphics ‡<br>752 × 410 graphics ‡ | CGA, HGC | Video-7 | 1.06 |
| PC **Eva/480** Tseng Laboratories Inc. | $680 | CMII emulation module†, parallel printer port, Dr Halo II | 1 year | Emulation, ANSI driver, mode changer, font utility, Lotus's *1-2-3*, *Symphony*, and *Windows* drivers, optional *AutoCAD* driver | Full | 60 (including CMII) | Tsang Laboratories ET2000 Series | 132 × 25 text<br>132 × 28 text<br>132 × 44 text<br>80 × 60 text‡<br>640 × 480 graphics‡ | CGA, HGC | Tseng Laboratories | 10/13/86 |
| **All Aboard** IDEAssociates Inc. | $1,095§ | Parallel port, serial port, composite video output, clock, hard disk controller, optional expanded memory | 1 year | Installation, clock software, EMS drivers | Full | 94 (Excluding EMS) | NSI Logic | None | CGA, MDA | NSI Logic | 10/13/85 |

PC—Indicates Editor's choice
* CGA = Color Graphics Adapter, HGC = Hercules Graphics Card, MDA = Monochrome Display Adapter
† Additional cost of $50 with the Eva board; included with the Eva/480 at no extra cost.
‡ Requires NEC Multisync monitor.
§ Price varies: 256K-byte version, $1,095; 1,024K-byte version, $1,395; 2-Mbyte version, $1,795.

# How to use 137% of your Multisync monitor.

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*With QuadEGA ProSync*

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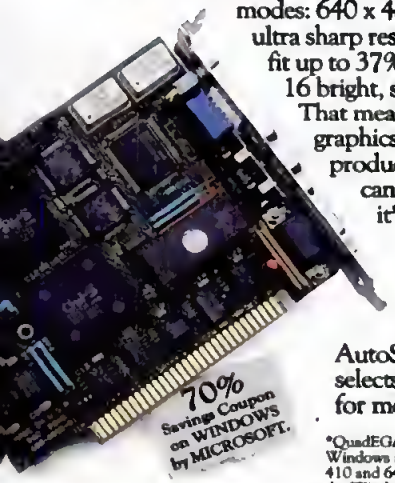


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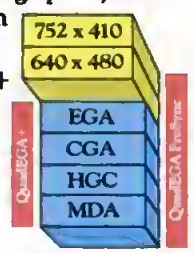
It's easy to run your favorite programs with QuadEGA ProSync. Our AutoSelect feature automatically selects the correct display mode for most software.

*QuadEGA ProSync includes drivers to run Microsoft Windows and software that runs under Windows in 752 x 410 and 640 x 480 modes, and a coupon good for 70% off the Windows package.

Together with your Multisync, QuadEGA ProSync delivers the leading edge technology that lets you make the most of desktop publishing, presentation graphics, and software that works best in the ultra high resolution mode.*

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CIRCLE 189 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

**Paradise AutoSwitch**
Paradise Systems Inc.
217 East Grand Ave.
S. San Franciso, CA 94080
(800) 527-7977
(800) 822-2020 (in Calif.)
**List Price:** $599
**In Short:** By switching to CGA, Hercules, or Plantronics compatibility modes without external software, the Paradise AutoSwitch is a no-fuss solution to the compatibility problem.

CIRCLE 623 ON READER SERVICE CARD

but I was told this is not entirely necessary; a utility program lets you override the switch, set either way.

Another AutoSwitch utility program allows you to switch to a very realistic CGA emulation (called "game mode") that even survives a reboot. It looks strange for text (the leftmost character repeats and the cursor is displaced one character to the left), but it works just fine for CGA graphics. You can boot up *Flight Simulator* and take off.

I didn't find Paradise's auto-switching technique as interesting or innovative as I thought I would. I also found a problem with this board when used on an IBM PC AT with the new AT keyboard. If I pressed the pause key while in a graphics mode, the board would often switch to a character mode or to some other graphics mode. What does the keyboard have to do with a video board? Well, besides intercepting the nonmaskable interrupt, the BIOS also intercepts the hardware keyboard interrupt. (An engineer at Paradise told me that the AutoSwitch BIOS has to watch for keyboard reboots so it can give the nonmaskable interrupt back to the PC BIOS for a while.) And what does the pause key have to do with a reboot? Well, who knows. There are 8 million compatibility stories in PC City. This is one of them.

## Overboard and All Aboard

IDEAssociates offers two EGA boards with funny names. They are the half-length Overboard and the full-length All Aboard. Both boards use the single-chip EGA developed by NSI Logic, along with NSI's ROM BIOS. (NSI's own EPIC Graphics Adapter card was reviewed in *PC Magazine*, Volume 5 Number 14.) The Overboard includes a serial port, a parallel port, a clock with battery backup, and a composite video output jack (the first I've ever seen on an EGA). The monitor and the parallel port connectors are both mounted on the backbrace of the board, while the serial connector requires a cable (which is included).

Now, if that's the half-length board, what could the full-length All Aboard possibly add? Would you believe a hard disk controller, 2 megabytes of Lotus/Intel/Microsoft expanded memory, and a microwave oven?

### WHAT? NO MICROWAVE OVEN?

OK—there's no microwave oven. And the expanded memory actually goes on an optional daughterboard. But the hard disk controller is for real: the manual says it supports 10-, 20-, and 30-megabyte drives from IDEA, Seagate Technology, Tandon

## PC LABS Benchmark Tests: EGA Boards

The Paradise AutoSwitch board clocks in with very fast BIOS code. But this speed is not entirely a free lunch. In the IBM EGA, the BIOS Teletype routine itself calls several other BIOS video services: to read the cursor, to write a character, to set the cursor, and to scroll the screen if necessary. However, the Paradise BIOS does all this without reentering the main BIOS video routine. This defeats screen-recall programs that rely upon intercepting BIOS calls to scroll the display. Most screen-recall programs will not work with the Paradise AutoSwitch board. None of the other boards tested here have this problem.

The Eva and Eva/480 boards from Tseng Laboratories have the slowest BIOS routines. If you're accustomed to an IBM EGA, you'll notice the difference immediately. This is probably just a software problem and Tseng needs to tighten up its BIOS code. .

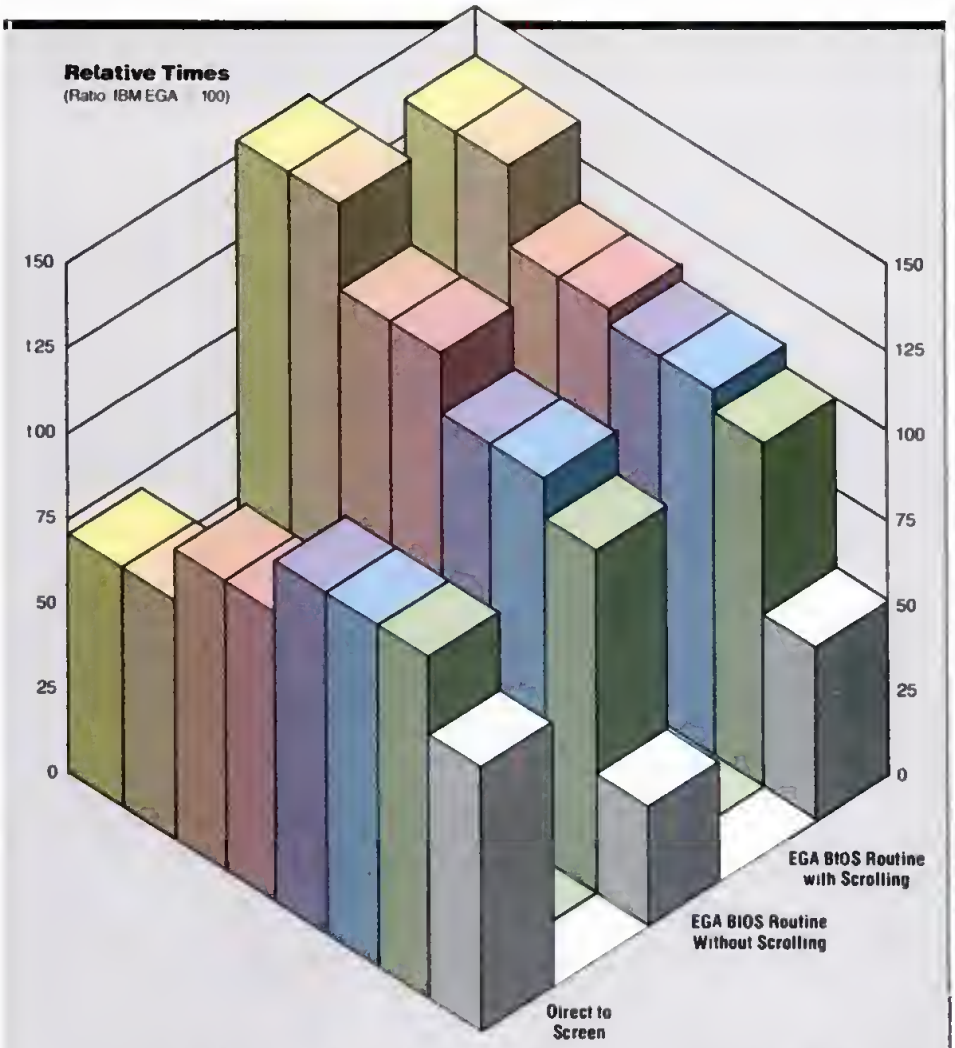
Although the IBM EGA and the EGA boards based on the Chips and Technologies EGA CHIPSet show the same times for writing directly to the screen, the other EGA implementations are faster, with Tseng Laboratories here taking the lead. These differences reflect differences in the chip designs. Although this test involved character data, the speed that programs can write graphics data to the display is roughly proportional to these results. The Eva and Eva/480, the Paradise AutoSwitch, and IDEAssociates' Overboard and All Aboard boards will all let graphics programs work slightly faster than will the IBM EGA, Video-7's VEGA Deluxe, and Quadram's QuadEGA ProSync boards.

**Performance Times**
(Times given in seconds and decimal seconds)

| Product | Direct to Screen | EGA BIOS Routine Without Scrolling | EGA BIOS Routine with Scrolling |
|---|---|---|---|
| Eva/480 | 9.0 | 18.3 | 23.5 |
| Eva | 9.0 | 18.3 | 23.5 |
| All Aboard | 11.0 | 15.2 | 19 7 |
| Overboard | 11.0 | 15.2 | 19 7 |
| QuadEGA ProSync | 13.0 | 13.2 | 18 8 |
| VEGA Deluxe | 13.0 | 13 2 | 18 8 |
| IBM EGA | 13.0 | 11.8 | 17.5 |
| Paradise AutoSwitch | 10.1 | 4.1 | 9.0 |

The **EGA BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times. The result shown is the total of the ten trials.

The **EGA BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video




mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times.

Corp., and Rodime. The port, clock, and hard disk configuration information are all stored in nonvolatile RAM on the board and are set with an installation program included with the board. The Overboard's small size is deceptive; it has nearly as many chips as the All Aboard, but they are mostly tiny surface-mounted chips, and both sides of the board are covered with them.

Since their NSI chips and BIOSs are the same as those on NSI's EPIC board, the two IDEAssociates boards incorporate that board's advantages and disadvantages. The EGA functions suffice for most purposes, but they're not fully compatible with the IBM and CTI implementations. The NSI EGA chip has a very good CGA and Monochrome Display Adapter (MDA) emulation mode built right into the hardware (though it won't emulate the Hercules).

**DEBATABLE ADVANTAGE** In the earlier survey of EGA boards, NSI's hardware CGA emulation proved clearly superior to the software emulation used in some of the CTI-based boards. But the NSI EPIC board included software to switch between EGA mode and CGA emulation mode; the IDEAssociates boards do not. Instead, you have to switch jumpers on the board itself. The manual doesn't even discuss the issue. All this is very strange, because the NSI chip's CGA and MDA emulation is the only thing that justifies using it instead of the Chips and Technologies CHIPSet.

The two boards have other quirks. They do not include the "feature connector" present on virtually all other EGA boards, nor do they use the 4-bit DIP switch that has become an EGA standard. The manual doesn't include any information about using the EGA as a secondary adapter, one of the things normally specified by these DIP switch settings.

If you're short on slot space or need the composite output jack, you might consider one of these boards. Otherwise, there's not much to recommend here.

**WHAT NEXT?** The rumors Stewart Alsop cited in our first cover story on the EGA ("The Enhanced Graphics Standard Comes of Age," *PC Magazine*, Volume 5

## PC MAGAZINE FACT FILE

**Overboard**
IDEAssociates Inc
29 Dunham Rd.
Billerica, MA 01821
(617) 663-6878
**List Price:** $595
**In Short:** With 67 surface-mounted chips on both sides of a half-length card, it's not surprising the Overboard includes parallel and serial ports and a battery-backed-up clock
CIRCLE 622 ON READER SERVICE CARD

**All Aboard**
IDEAssociates Inc.
29 Dunham Rd.
Billerica, MA 01821
(617) 663-6878
**List Price:** 256K version, $1,095; 1,024K version, $1,395; 2-Mbyte version, $1,795.
**In Short:** Adding a hard disk controller and optional expanded memory to the Overboard makes this a one-slot solution with lots of functionality.
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- MANAGING YOUR MONEY™ (1.5, 1.51, 2.0)
- MICROSOFT WORD™ (1.15, 2.0, 2.01)
- PFS: ACCESS™ (1984 Ed.)
- PFS: PLAN™ (B)
- PFS: GRAPH™ (B)
- PFS: WRITE™ (1.01, C)
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Christopher O Malley,
PERSONAL COMPUTING, April '86

PC "Because copy protection can interfere with the ability to back up a hard disk, business-oriented users may prefer programs like TranSec's UNlock series."
Winn L. Rosch, PC MAGAZINE, May 27, 1986

BYTE "UNlock 4.7 defeats the latest Prolok and SuperLock type of copy protection schema. It's menu-driven and works fine on the programs it's supposed to work on: Lotus 1-2-3, dBase III, Framework, Symphony, Paradox, and several others."
Jerry Pournelle, BYTE, Feb. '86

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## ■ EGA BOARDS

Number 14)—that IBM plans to release a "super EGA"—persist to this day. I haven't seen the board. I haven't talked with anybody who admits to seeing the board. But I have talked with somebody who knows somebody who's seen it but wouldn't say anything about it.

A new board from IBM may not even matter, particularly if it offers only 640- by 480-pixel resolution. Thanks to Video-7 and Tseng Laboratories, we have that right now at a price IBM just can't beat, while NEC's MultiSync monitor lets us enjoy that resolution and much more. My own personal theory is that IBM is absolutely

■ Today we are on the threshold of a video technology explosion. Video processor chips will soon give us high resolution, big screens, and fast graphics.

stymied by the problem of how to make its new board *in*compatible with the NEC MultiSync.

Today we are on the threshold of a video technology explosion. Video processor chips from Intel, Texas Instruments, and Hitachi will soon give us high resolution, big screens, and fast graphics. *Microsoft Windows* will provide device independence and rid us of these crazy compatibility issues. In time, we shall look upon the EGA, now just over 2 years old, as merely an adequate, medium-resolution color graphics board.

Right now, though, the EGA really hits the spot. And 480-line modes are a great dessert. PC

*Charles Petzold is a contributing editor of* PC Magazine. *He tested and reviewed the products in our initial cover story on EGA boards (*PC Magazine, *Volume 5 Number 14). He also writes the PC Tutor column.*

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provements
GA, today's
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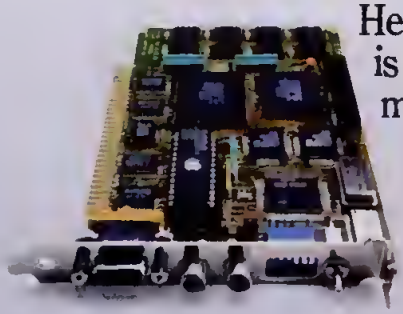
That, in turn, means sharper lines. More brilliant colors. And less strain on your eyes. (Of course, you can't see more than your monitor will display. So for more than 640 x 350, the VEGA Deluxe requires a Multisync® or equivalent.)

The VEGA Deluxe is compatible with every other video standard: EGA, CGA, Hercules and MDA. And it automatically selects which standard is right for your software's needs when used with a compatible monitor.



Not only that, the VEGA Deluxe includes high-resolution drivers for Microsoft Windows and Lotus 1-2-3 with 120 columns and 43 lines. EASYCAD, EGA Paint, GEM, Dr. Halo, In•A•Vision, Windows Draw, Windows Graph, and many more now support VEGA Deluxe high resolution.

Want more information? Just call 1-800-238-0101 for the name of the Video Seven dealer nearest you. (In California, call 1-800-962-5700.)

And get ready for a real eye-opening experience.

Video Seven Inc., 47320 Mission Falls Court, Fremont, CA 94539.

VIDEO SEVEN

High resolution modes require TTL color monitors capable of 25 KHZ and 29 4 KHZ. Trademarks: VEGA Deluxe – Video Seven Inc., Hercules – Hercules Computer Technology, MultiSync – NEC Information Systems, Inc., EASYCAD – Evolution Computing, EGA Paint – Rix SoftWorks, Inc.; GEM – Digital Research Corp.; Dr. Halo – Media Cybernetics, In•A•Vision, Windows Draw, Windows Graph – Micrografx, Inc. Registered trademarks. IBM – International Business Machines Corporation, Video Seven – Video Seven, Inc., Lotus 1 2 3 – Lotus Development Corp., Microsoft – Microsoft Corp. Video Seven reserves the right to change specifications without notice.

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**Downloading a mainframe application?** ECM memory runs with any program that uses DOS for screen services including RM and MS FORTRAN and MS and LATTICE C! This means you have an additional 384K available for oversized applications. Programs which write directly to the screen require a simple patch to adhere to the new standard. MicroWay has already developed patches for the Lotus, WORDSTAR and AUTOCAD screen drivers. Release 1A of 1-2-3 jumps from 535,516 to 916,444 bytes available and runs faster than Release 2 for most worksheets.

**Number Smasher/ECM is 100% compatible** with all hardware and software including EMS and EGA boards. The compatibility is a result of control: its speed is switch, keyboard or software selectable from 4.77 MHz to 12.0 MHz. Applications which have not been upgraded to ECM can still be run by setting DOS to 640K or 704K and using the memory above DOS for I/O enhancers.

**Number Smasher/ECM runs floating point bound programs faster** than an AT or any other 80286 based machine. In fact, Number Smasher's 12 MHz 8087 runs a factor of three faster than the standard 80287 on the AT, delivering up to 125 kflops. Software is included for RAM Disk, print spooler, and disk caching, which speeds up floppy and hard disks by a factor of 2 to 10!

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CIRCLE 159 ON READER SERVICE CARD

# CAD AT ANY PRICE

*Price and performance ground rules for computer-aided design software have changed again with true CAD selling for as little as $80—and as much as $8,000.*

Computer-aided drafting and design programs for personal computers were once pale but costly shadows of the heavyweight mainframe versions. That wasn't too long ago, but things have changed: inexpensive PC hardware and software now offer the functionality of larger CAD systems at but a fraction of the cost.

Until about a year ago, full-featured microcomputer CAD programs cost between $2,000 and $3,000. The market leader, *AutoCAD*, and its main competitors—programs like *VersaCAD*, and *CADvance*—still do. But new entries sporting much lower prices have succeeded in bringing CAD to a wider audience. *Generic CADD*, *In*a*Vision*, and *Drafix* all cost less than $500. While they don't offer all the features of the more costly CAD programs, you can use them for serious design and drafting work (see "CAD: The Big Picture for Micros," *PC Magazine*, Volume 5 Number 5).

From among the legion of recent CAD packages, we chose four that represent the wide range of price and performance. These programs cover an incredible two orders of magnitude in pricing: *AutoSketch*, a new low-end entry from Autodesk, sells for only $80, while the impressive *MicroCadam* from IBM Corp. rockets microcomputer CAD to a stratospheric $8,000 price point. In between, T&W System's $500 *EasyCAD* and IBM's $2,000 *CADWrite* occupy popular checkpoints on the price continuum.

Each program has much to offer at its own level. This welcome diversity means you're the winner: you can pick a CAD program that fits both your budget and your needs.

## AutoSketch

Autodesk, manufacturer of the market-dominating *AutoCAD*, has entered the low-end fray with *AutoSketch*. While the name implies a painting and drawing orientation, *AutoSketch* turns out to be a real CAD program with much to offer at its remarkable price of only $79.95.

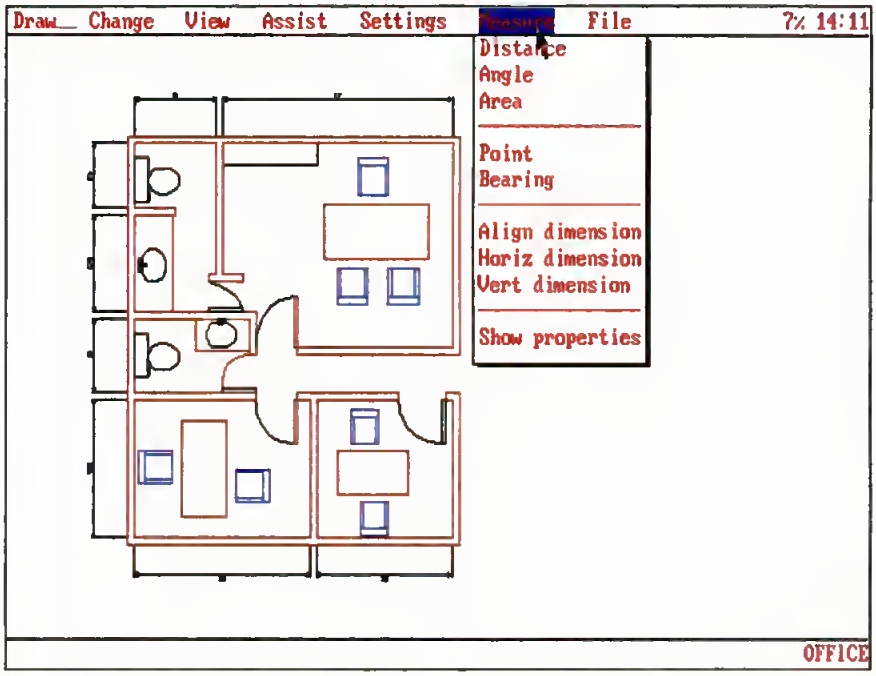
Installing *AutoSketch*, which isn't copy protected, is easy. Through a simple dialogue, it finds out what peripherals you're using and installs the necessary drivers automatically. The list of supported devices is much shorter than that for AutoCAD but adequate for the program's intended users. It includes CGA, EGA, and Hercules video; Microsoft Mouse and ADI pointer; common Epson, IBM, Okidata, and Texas Instruments dot matrix printers; Hewlett-Packard and PostScript-supporting laser printers; and Hewlett-Packard and Houston Instrument plotters.

The user interface isn't anything like *AutoCAD*'s hierarchical tree menu structure. *AutoSketch*'s interface is strongly derivative of the Macintosh interface, with pull-down menus across the top of the screen and occasional dialog boxes to give you messages and let you set parameters. The program—and by extension the user—benefits from the logical organization and intuitive operation typical of the Macintosh approach. In addition, 20 PC function-key combinations handle many common commands and options.

Although *AutoSketch* resembles popular painting programs visually, it is an object-oriented program. It stores an object's coordinates and entity type rather than a bit-mapped image. *AutoSketch* images are manipulated entirely in RAM, so the amount of memory in your machine determines the complexity of the drawings you can handle. Since even the most complex sample image that the program supplied left plenty of room on my 640K PC AT, this design strategy isn't likely to present many difficulties.

*AutoSketch* drawing entities include arcs, boxes, circles, lines, and points. The program doesn't offer many alternative methods of drawing these entities, but its straightforward techniques are easy to understand and use. Other entities available are polygons (which are merely connected line segments and not standard polygons), spline curves specified with control points and frames (much the same as in *EasyCAD*), and text. The program can draw in one font only, but you can specify height, angle, slant, and width compression or expansion. You can also insert predrawn parts.

*AutoSketch* offers semiautomatic linear dimensioning, which it can place horizontal, vertical, or parallel to an angled line. Like *EasyCAD*, *AutoSketch* automatically changes the dimension text if you use an editing command to change a dimensioned line's length. Even *AutoCAD* doesn't include this advanced "associative dimensioning."




*Arcs, boxes, circles, lines, and points are four of the drawing entities included in* AutoSketch. *Though the program draws only in one font, you can specify height, angle, slant, and more.*

Drawing aids include Ortho, used for constraining actions to right angles; Visible Grid with aspect for differing *x* and *y* spacing; Snap, also with adjustable aspect; Frame, used to display the definition points for curves for ready editing; and Attach, *AutoSketch*'s object snap system. *AutoSketch* supports object snaps to the endpoints and midpoints of arcs and lines, the center and four quadrants of circles and arcs, and to points or the ends of text lines.

**EDITING FACILITIES** Editing facilities are good, especially for such an inexpensive program. Entities can be erased, moved, copied, rotated in 1-degree steps, scaled to a larger or smaller size, mirrored at any angle, or broken (chop off one end or break an entity in two). *AutoSketch* includes the useful Stretch command, introduced in *AutoCAD*, which lets you extend lines that connect items.

A clever scheme simplifies the process of selecting entities to edit. You choose specific entities by pointing at them with a hand symbol, but if you click on an empty area, you get a windowing box that defines an area to edit. If you specify a second corner to the right of the first clickpoint, *AutoSketch* draws a solid box. Only objects that lie entirely within this box can be edited. If the second point is to the left of the first, you get a dotted box, which signifies that objects that merely cross the box are selected as well. You can also group and ungroup several entities so that you can manipulate them together. Since *AutoCAD*'s excellent Drag mode is built into *AutoSketch*, you can see the effects of many editing commands before you finalize them.

*AutoSketch* lets you undo your last drawing or editing action, all the way back to the very first action of the drawing session. This feature makes it much more flexible than programs that can undo only the last action or, even worse, can't undo any at all. You can even redo an undo if you go one step too far.

*AutoSketch*'s zooming and panning provisions are typical of microcomputer CAD programs. You can specify zoom magnification or reduction with a numeric factor or by drawing a box, or you can request the program either to fill the display with the active area or fill to limits that you've specified elsewhere.

The Settings menu controls a wide vari-

PC MAGAZINE FACT FILE

*AutoSketch*
Autodesk Inc.
2320 Marinship Way
Sausalito, CA 94965
(415) 332-2344
**List Price:** $79.95
**Requires:** 512K RAM, 2 floppy disk drives or 1 hard disk, DOS 2.0 or later, joystick, Hercules graphics card or IBM CGA or EGA card, ABI pointer, Koala Pad or Microsoft Mouse or emulator.
**In Short:** This inexpensive CAD program from the makers of *AutoCAD* is great for beginners (despite inadequate documentation) but has much to offer CAD users on every level. Not copy protected.

CIRCLE 631 ON READER SERVICE CARD

ety of *AutoSketch* options. Up to 10 numbered (but not named) layers are available, each of which can be displayed. You can select the color, line type, or layer for subsequent entities and also specify the accuracy needed for object selections. Objects on any given layer are not restricted to one color, as they are in the newest version of *AutoCAD*.

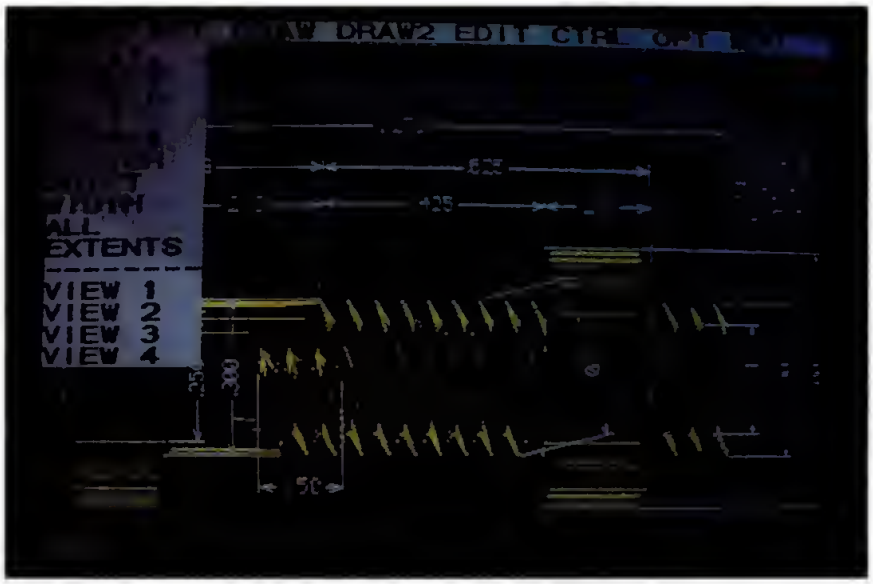
*AutoSketch* can calculate the distance between two points, angles, the area of a polygon, bearings, and more. You can display the pointer coordinates continuously but not in conjunction with other activities; consequently, this feature isn't terribly useful. Although *AutoSketch* can't import a standard DXF format file, it can create one; this allows you to export your drawings to *AutoCAD*.

*AutoSketch* plotting and printing facilities include two clever ways of specifying areas to plot. A Plot Box lets you window an area of the current image that the program will magnify before plotting. Conversely, a Clip Box isolates a small area of the drawing that will be plotted at normal size.

*AutoSketch*'s documentation is terse and barely adequate. Sufficient only for someone experienced in CAD, it won't shed much light on the subject for beginners, who are the program's primary target. The documentation fails to indicate how to configure and connect the supported peripherals.

**LACKING IN OPTIONS** It's not surprising to find that *AutoSketch* lacks many options when compared with a full-featured, expensive CAD program. It has no parallel lines, ellipses, or regular polygons. Dimensioning is limited, and there's no free-form sketching mode, no attribute system, no provision for fillet, chamfer, or hatch, and no array system. Perhaps most important, there's no way to draw or plot wide lines or curves.

Yet *AutoSketch* is a delight to use. Its Mac-style interface is much easier to use than *AutoCAD*'s menu interface. It's so good that anyone who's used a CAD program before hardly needs to refer to the manual. Many new and interesting ideas are scattered through the program, and the basics work well, too. *AutoSketch* seems a little slower than *AutoCAD*, but its performance is more than satisfactory.




EasyCAD *permits you to define four views of an image and plot or zoom directly to any one. You can zoom using magnification, reduction, windowing, or center of interest.*

Can a program that is so inexpensive produce serious, professional CAD or is it just a toy? The answer is clear: *AutoSketch* is a solid tool that's both easy to learn and use, and it creates quality work. The program will be equally at home teaching CAD to entry-level beginners and in professional settings that don't need the extra capabilities (and extra cost) of programs like *AutoCAD*.

## EasyCAD

On the surface, *EasyCAD* lacks the pizzazz of some of its competitors. Lurking below the surface, though, is a solid and appealing program with much to offer.

This moderately priced CAD program, developed by Evolution Computing and marketed by T&W Systems, isn't copy protected, and an excellent interactive installation utility makes it simple to install. You merely indicate the hardware you're using; file copying and driver installation are automatic. You can modify parameters like screen aspect ratio, mouse sensitivity, and port assignments.

*EasyCAD* supports a reasonably broad range of video adapters (including the new extra-resolution 640-pixel by 480-line EGA boards like the Tseng Laboratories Eva and the enhanced Video-7 VEGA Deluxe, both reviewed in this issue), a few mice and digitizers, Hewlett-Packard and Houston Instrument plotters, IBM Graphics Printers and Proprinters, and the HP Laserjet. This hardware spectrum is a bit sparse but will meet the needs of most. The program will use an 8087 or 80287 math coprocessor if one is available.

Like *AutoSketch*'s user interface, *EasyCAD*'s is inspired by the Macintosh: it has both pull-down menus and dialog boxes. EGA users have the option of selecting a smaller and more elegant typeface if de-

*(continues)*

PC MAGAZINE FACT FILE

*EasyCAD*, **Version 1.05**
(Developed by Evolution Computing)
T&W Systems, Inc.
7372 Prince Dr., #106
Huntington Beach, CA 92647
(714) 847-9960

**List Price:** $495
**Requires:** 256K RAM, 1 floppy disk drive, PC- or MS-DOS 2.0 or later.
**In Short:** A solid, reasonably priced CAD program that leaves out features important for certain applications but should please most CAD users. Not copy protected.

CIRCLE 630 ON READER SERVICE CARD

# 'Twas days before Christmas,

*and all through the offices, many creatures were stirring, even the bosses. Year-end figures were wrung by the accountants with care. In the hopes that black ink would somehow appear there.*

✓ **denotes IBM-AT compatibility.**
★ **denotes IBM-PCjr compatibility.**
(call for specific requirements)

## SOFTWARE

We only carry the latest versions of products. Version numbers in our ads are current at press time.

**Alpha Software** *(not copy-protected)*
★ ✓Keyworks 2.0 ..... $49.
★ ✓Alpha/three 1.0 ..... 223.
**Application Techniques**
✓Pizazz 1.0 *(not copy-protected)*
*See what your printer's been missing* ..... 35.
**Ashton-Tate** *(not copy-protected)*
✓dBase III Plus 1.1 ..... call
✓Framework II 1.1 ..... call
★ ✓Sign-Master 5.1 *(copy-protected)* ..... 157.
✓Diagram-Master 5.01 *(copy-protected)* .. 207.
★ ✓Chart-Master 6.2 *(copy-protected)* ..... 237.
★ ✓Map-Master 1.0 *(copy-protected)* ..... 245.
★ ✓MultiMate 3.31 ..... call
*Keyboard for MultiMate Advantage* ..... 259.
✓MultiMate Advantage 3.6 ..... call
**Best Programs** *(not copy-protected)*
✓PC/Fixed Asset System 3.1 ..... 359.
**Bible Research** *(not copy-protected)*
★ ✓THE WORD 3.1 *(KJV Bible)* ..... 159.
★ ✓THE WORD 3.1 *(NIV Bible)* ..... 159.
**Borland International** *(not copy-protected)*
★ ✓Turbo Tutor 2.0 ..... 24.
★ ✓Turbo Database Toolbox 1.2 ..... 41.
★ ✓Turbo Graphix Toolbox 1.0 ..... 41.
★ ✓Turbo Editor Toolbox 1.0 ..... 41.
★ ✓Turbo Newpak *(Gameworks and Editor)* ... 52.
★ ✓Turbo Lightning 1.0 ..... 59.
★ ✓Word Wizard 1.0 ..... 41.
★ ✓Turbo Pascal 3.0 w/BCD & 8087 support .. 59.
★ ✓Turbo Pascal w/Turbo Tutor ..... 75.
★ ✓Turbo Prolog 1.1 ..... 59.
★ ✓Turbo Family Jumbo Pack ..... 187.
★ ✓Sidekick 1.5 ..... 51.
★ ✓Traveling Sidekick 1.0 ..... 43.
★ ✓Traveling Sidekick w/Sidekick ..... 73.
★ ✓Reflex 1.1 ..... 87.
★ ✓Reflex Workshop 1.0 ..... 41.
★ ✓Superkey 1.1 ..... 41.
★ ✓Superkey/Sidekick Package ..... 69.
**BPI Accounting** *(not copy-protected)*
*ENTRY SERIES*
✓General Accounting C.13 ..... 299.
✓Business Builder ..... 399.
**Breakthrough** *(not copy-protected)*
✓Timeline 2.0 ..... 239.
✓Timeline Graphics 1.0 ..... 105.

**PC Connection Software Special**
*through January 31, 1987*

**STONE & ASSOCIATES**
★ ✓**2nd Math**
★ ✓**Algebra + Level 1**

Are you the only one who ever has fun with a computer? Do your kids think that all it does is spreadsheets and checkbooks? These two educational programs for children not only teach them how to add, subtract, and so forth, but they're also fun, colorful, and the kids will actually learn something!

- From Stone & Associates, leaders in quality educational software
- Animated characters, colorful objects, playful sounds.
- Big, bold graphics that can be easily seen and understood
- Increasing levels of difficulty to provide a continuing challenge
- Great fun for children of all ages

For the IBM PC, XT, AT, PCjr
2nd Math (requires CGA, BASICA or GW-BASIC) ..... $24.
Algebra + Level 1 (requires CGA, BASICA or GW-BASIC) ..... $24.

**Broderbund** *(copy-protected)*
★ ✓Bank Street Writer Plus *(not copy-protected)* 59.
★ ✓Print Shop ..... 35.
★ ✓Graphics Library 1 ..... 22.
★ ✓Graphics Library 2 ..... 22.
**Computer Associates** *(not copy-protected)*
★ ✓SuperCalc 4 1.0 ..... call
**Consumers Software** *(not copy-protected)*
✓Spreadsheet Auditor 3.0 *(check your work)* 89.
**Dac Software** *(not copy-protected)*
✓Dac Accounting Tutor ..... 15.
✓Dac Payroll Tutor ..... 15.
✓Dac Easy Port ..... 19.
✓Dac Easy Mate ..... 26.
✓Dac Easy Word ..... 32.
✓Dac Easy Payroll ..... 32.
★ ✓Dac Easy Accounting ..... 45.
**Decision Resources** *(see Ashton-Tate)*
**Digital Research** *(not copy-protected)*
✓GEM Draw 1.0 *(includes GEM Desktop)* .. 149.
✓GEM Collection 1.0 ..... 119.

**Dow Jones** *(copy-protected)*
Market Manager Plus 2.0 ..... $159.
✓Spreadsheet Link 1.2 ..... 159.
**Executive Systems** *(not copy-protected)*
✓XTREE 2.0 ..... 37.
✓Hot 1.0 *(DOS utility)* ..... 41.
**5th Generation** *(not copy-protected)*
✓Fastback 5.13 ..... 97.
**Friendlysoft** *(not copy-protected)*
★ ✓Friendlywriter 3.2 *(w/70,000 word speller)* 55.
**Funk Software** *(not copy-protected)*
★ ✓Sideways 3.11 ..... 39.
**Generic Software** *(not copy-protected)*
✓Generic CADD 2.0 *(inexpensive drafting package)* ..... 69.
**Graphic Communications**
*(see Lotus Development)*
**Harvard Associates** *(not copy-protected)*
★ ✓PC LOGO 2.0 ..... 89.
**Infocom** *(not copy-protected)*
★ ✓Cornerstone 5.2 ..... 59.
**Lifetree** *(not copy-protected)*
★ ✓Volkswriter Deluxe Plus 1.0 ..... 69.
✓Words and Figures 1.0 ..... 115.
★ ✓Volkswriter 3 1.0 ..... 147.
★ ✓Volkswriter Scientific 1.0 ..... 289.
**Living Videotext** *(not copy-protected)*
✓ThinkTank 2.1 ..... 105.
★ ✓Ready 1.0 ..... 49.
**Lotus Development, Inc.**
✓Freelance Plus *(not copy-protected)* .... 359.
✓Graphwriter Combo Pack 4.3 *(not copy-protected)* ..... call
**Mark Williams** *(not copy-protected)*
✓Let's C 3.1.1 ..... 43.
✓C Programming System 3.1.1 ..... 259.
**Micro Education (MECA)** *(copy-protected)*
★ ✓Jim Fixx's Running Program ..... 21.
★ ✓Managing Your Money 3.0 ..... 115.
★ ✓Managing the Market 1.0 ..... 85.
**Micropro** *(not copy-protected)*
✓Easy Extra *(Easy with Easy Mail)* ..... 89.
★ ✓WordStar 3.31 ..... 179.
✓WordStar Propak 3.31 ..... 259.
✓WordStar 2000 Plus Release 2 ..... 285.
**Microrim** *(not copy-protected)*
✓Extended Report Writer 1.3 ..... 85.
✓Clout 2.0 ..... 135.
✓R:base 5000 1.01 ..... call
✓R:base System V 1.0 ..... 359.
**Microsoft** *(not copy-protected)*
✓Windows 1.03 ..... 65.
★ ✓Multiplan 2.01 ..... 119.
✓Microsoft Access 1.01 ..... 163.
★ ✓Microsoft Chart 2.02 ..... 197.
✓Microsoft Word 3.1 ..... 279.
★ ✓Microsoft Project 3.0 ..... 239.

For the IBM-PC (XT & AT) *Exclusively.*

# PC CONNECTION®

# When inside my brain,

*there arose such a clatter,*
*I looked up from my keyboard to see what*
*was the matter. Away to my notepad I flew like a flash,*
*to see what I'd done in Christmases past.*

*LANGUAGES*
★ Quick Basic 2.0 . . . $59.
★ Macro Assembler 4.0 . . . 97.
★ Pascal Compiler 3.3 . . . 175.
★ Fortran Compiler 3.31 . . . 229.
★ C Compiler 4.0 . . . 279.
Cobol Compiler 2.1 . . . 439.

**Microstuf** *(not copy-protected)*
★ Crosstalk XVI 3.61 . . . 95.
Remote 1.3 . . . 95.
Transportar 1.4 . . . 149.

**Migent Software** *(not copy-protected)*
Ability 1.0A . . . 65.

**Monogram** *(not copy-protected)*
Dollars & Sense 2.0 . . . 105.

**MultiMate International** *(see Ashton-Tate)*

**Nantucket Software** *(not copy-protected)*
Clipper *(Autumn '86)* . . . 349.

**North Edge Software** *(not copy-protected)*
Timeslips 2.2E . . . 75.

**Peperback Software** *(copy-protected)*
Wines on Disk . . . 25.
★ VP-Plannar 1.0 . . . 57.
★ VP-Info 1.0 . . . 54.

**Personics** *(not copy-protected)*
SmartNotes 1.0 . . . 49.

**Peter Norton** *(not copy-protected)*
★ Norton Commandar 1.0 . . . 36.
★ Norton Utilities 3.1 . . . 59.

**Powerbase** *(not copy-protected)*
Powerbase 2.2 . . . 189.

**Quarterdeck** *(not copy-protected)*
DESQView 1.3 . . . 65.

**Sierra On-Line**
★ Smart Money 1.0 . . . 49.

**Simon & Schuster** *(not copy-protected)*
★ Webstar's New World Speller 1.3 . . . 39.
★ Webstar's New World Thesaurus 1.0 . . . 43.
★ Webster's New World Writer 1.01 *(includes Thesaurus & Speller)* . . . 109.

**Softlogic Solutions** *(copy-protected)*
Double DOS 4.0 *(PC concurrency)* . . . 33.
Software Carousel 2.0 *(PC multitasking, keep up to 10 programs resident)* . . . 33.
Disk Optimizer 2.0 . . . 35.

**Software Group** *(not copy-protected)*
Enable 1.1 . . . call

**Software Publishing** *(not copy-protected)*
★ PFS First Choice 1.0 *(includes word processor, spreadsheet, database, communications)* . . . 89.
Professional Write 1.0 . . . 119.
Personal Publishar 1.0 . . . 109.
Professional File 1.0 . . . 149.
Harvard Presentation Graphics A:01 . . . 245.
Harvard Total Project Manager 1.12 . . . 289.

**Softstyle** *(not copy-protected)*
★ Printworks Dot Matrix 1.05 . . . 39

**Springboard** *(copy-protected)*
★ Certificate Maker . . . $34.
★ Newsroom . . . 35.
★ Clip Art Volume 1 *(for Newsroom)* . . . 19.
★ Clip Art Volume 2 *(for Newsroom)* . . . 25.
★ Newsroom•Pro *(not copy-protected)* . . . 79.

**Symentec** *(not copy-protected)*
Q & A 2.0 . . . call

**True BASIC, Inc.** *(not copy-protected)*
★ True BASIC 1.0 . . . 109.
Runtime 1.0 . . . 89.
True BASIC Libraries . . . each 32.

**Turner Hall** *(not copy-protected)*
SQZ! 1.5 *(for Lotus compactness)* . . . 49.
Note-It 2.0 *(notes on spreadsheets)* . . . 49.

**Unison** *(copy-protected)*
★ Printmaster . . . 37.
★ Art Gallary 1 . . . 22.
★ Art Gallary 2 . . . 18.

**WordPerfect Corp.** *(not copy-protected)*
★ WordPerfect Library . . . 59.
Math Plan 2.1 . . . 89.
★ WordPerfect 4.2 *(one of the highest rated word processors)* . . . 239.

## TRAINING

**ATI** *(copy-protected)*
★ *SKILL BUILDER PROGRAMS*
Intro and How to Use:
PC-DOS MS-DOS
Compaq Typing Tutor
IBM-PC BASIC . . . *each* 33.
★ *TRAINING POWER PROGRAMS*
How to Use:
Lotus 1-2-3 Wordperfect dBase III Plus
WordStar Displaywrita 3 R:base 5000
MultiMata Advantage
Symphony . . . *each* 43.

**Individuel Software** *(copy-protected)*
★ The Instructor II . . . 26.
★ Professor DOS . . . 33.
★ Tutorial Set *(both items above)* . . . 49.
★ Typing Instructor II . . . 26.
★ Training for Lotus 1-2-3 *(for vers. 1A & 2)* . . . 37.
★ Training for dBase III . . . 37.
★ Training for Project Management . . . 37.

**Microsoft** *(not copy-protected)*
★ Learning DOS *(for any version)* . . . 33.

**Scarborough** *(copy-protected)*
★ Mastertype . . . $26.

**Simon & Schuster** *(not copy-protected)*
★ Typing Tutor III 1.5 . . . 33.

## EDUCATIONAL

All educational programs listed are copy-protected except whara noted.

**Barron's**
★ Computer SAT . . . 35.

**Designware** *(reqs. CGA)*
★ Spellicopter *(ages 6 to adult)* . . . 22.
★ States and Traits *(ages 9+)* . . . 25.

**Eduware** *(reqs. CGA)*
★ Algebra 1,2,3, or 4 . . . 22.

**Harcourt Braes Jovanovich**
★ Computer SAT . . . 27.

**Scarborough** *(reqs. CGA)*
★ Build-A-Book About Me *(ages 2 to 12)* . . . 19.

**Springboard** *(reqs. CGA)*
★ Early Games *(ages 2½ to 6)* . . . 22.
★ Piece of Cake Math *(ages 7 to 13)* . . . 22.
★ Easy as ABC *(ages 3 to 6)* . . . 24.

**Stone & Associatee** *(reqs. CGA)*
★ Memory Master *(ages 2 to 6)* . . . 27.
★ My Letters,Numbers,Words *(ages 1 to 5)* . . . 27.
★ Kids Stuff *(ages 3 to 8)* . . . 27.
★ 2nd Math *(ages 5 to 8)* . . . special
★ Algebra+ Level 1 *(ages 13 & up)* . . . special

**The Learning Company** *(reqs. CGA)*
★ Magic Spells *(ages 6 to 12)* . . . 23.
★ Word Spinner *(ages 6 to 10)* . . . 23.
★ Moptown Parade *(ages 6 to 10)* . . . 26.
★ Reader Rabbit *(ages 5 to 7)* . . . 26.
★ Rocky's Boots *(ages 9 and up)* . . . 32.
★ Robot Odyssey *(ages 12 and up)* . . . 32.

**True BASIC, Inc.** *(not copy-protected)*
★ Calculus *(reqs. True Basic package)* . . . 32.
★ PreCalculus *(reqs. True Basic package)* . . . 32.
★ Probability *(reqs. True Basic package)* . . . 32.
★ Trigonometry *(reqs. True Basic package)* . . . 32.
★ Algebra *(reqs. True Basic package)* . . . 32.

## RECREATIONAL

All recreational programs listed are copy-protected except where noted.

**Blue Chip**
*Realistic financial simulations.*
★ Managing for Success *(American Dream)* . . . 36.
★ Baron . . . 36.
★ Millionaire . . . 36.
★ Squire . . . 36.
★ Tycoon . . . 36.

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320M

For the IBM-PC (XT & AT) *Exclusively.*

PC CONNECTION®

# The glow on the screen,

*told a tale sad but true. I'd forgotten to get presents for people I knew! A modem for mother, Zork for the kids. Tycoon for the chief, and a hard drive for Sid.*

**Broderbund** *(reqs. CGA)*
- ⋆Lode Runner ... $22.
- ⋆Championship Lode Runner ... 22.
- ⋆⌐Ancient Art of War ... 27.
- ⋆⌐Breakers *(text game)* ... 29.
- ⋆⌐Toy Shop ... 39.

**CBS** *(reqs. CGA)*
- ⋆Murder by the Dozen ... 17.

**Electronic Arts** *(reqs. CGA)*
- ⋆Pinball Construction Set ... 17.
- ⋆Music Construction Set ... 17.
- ⋆Dr J/Larry Bird One-on-One ... 17.
- ⋆⌐Starflight ... 32.

**Friendlysoft** *(not copy-protected)*
- ⋆⌐PC Arcade *(10 games)* ... 35.

**Funtastic** *(reqs. CGA)*
*Great arcade style games.*
- ⋆⌐Big Top *(hours of fun)* ... 27.
- ⋆⌐Cosmic Crusader ... 27.
- ⋆⌐Master Miner ... 27.
- ⋆⌐Snack Attack II ... 27.

**Hayden Software**
- ⋆⌐Sargon III *(highest rated Chess program)* ... 32.

**Infocom** *(not copy-protected)*
*Sophisticated interactive fiction*
*Difficulty levels shown in italics*
⌐*STANDARD*
⋆Enchanter ⋆the Witness ⋆Planetfall
⋆Cutthroat ⋆Wishbringer ⋆Zork I
⋆Ballyhoo Fooblitzky
⋆Hitchhiker's Guide ... *each* 24
⋆⌐*ADVANCED*
Zork II Zork III Sorcerer
A Mind Forever Voyaging ... *each* 27.
⋆⌐*EXPERT*
Spellbreaker ... 29.
*Invisiclues (hint booklets). Specify game* ... 6.

**Microleague Sports** *(reqs. CGA)*
- ⋆⌐Microleague Baseball ... 25.

**Microprose** *(reqs. CGA)*
- ⋆⌐F-15 Srike Eagle ... 22.
- ⋆⌐Silent Service *(WWII submarine in the South Pacific)* ... 22.
- ⋆⌐Hellcat Ace ... 22.
- ⋆⌐Spitfire Ace ... 22.
- ⋆⌐Solo Flight ... 22.

**Microsoft** *(reqs. graphics brd.)*
- ⋆⌐Flight Simulator 2.12 ... 32.

**Mindscape** *(reqs. graphics brd.)*
- ⌐Balance of Power *(avoid nuclear war)* ... 30.

**1Step Software** *(reqs. CGA)*
- ⋆⌐Golf's Best *(Pinehurst)* ... 19.
- ⋆⌐Golf's Best *(St. Andrew's)* ... 19.

**Origin Systems** *(reqs. CGA)*
- ⋆⌐Ultima 3 ... 39.

**Parlor Software** *(not copy-protected)*
- ⋆⌐Bridge Parlor *(best Bridge simulation)* ... 49.

**PC Connection Hardware Special**
*through January 31, 1987*

**EPSON**
**⌐LQ-1000**

Aren't you glad you waited to buy a printer? Epson's latest printer is another winner. Crisp, high-quality dot matrix printing with Epson's renowned reliability and compatibility. Loads of standard features, and some surprising options, too.

- 24-pin printhead for superb near-letter-quality print
- 180 cps (draft mode, 60 cps NLQ mode) for fast, accurate results
- Supports all standard Epson character fonts, including proportional and 15 cpi
- Both Centronics parallel and RS-232C serial interfaces standard
- Options include tractor feed, cut sheet feeder. Identity Modules for extended compatibility, and Font Modules for additional print fonts.

For the IBM-PC, XT, & AT (1 year) .... $747.

**PCSoftware** *(not copy-protected)*
- ⋆⌐Championship Blackjack ... 25.
- ⋆⌐Armchair Quarterback ... 25.
- ⋆⌐Chess 2001 ... 25.
- ⋆⌐Championship Backgammon ... 26.

**Sierra On-Line** *(reqs. CGA)*
- ⋆⌐Championship Boxing ... 24.
- ⋆⌐Black Cauldron ... 25.
- ⋆⌐Space Quest ... 32.
- ⋆⌐King's Quest ... 33.
- ⋆⌐King's Quest II ... 33.
- ⋆⌐King's Quest III ... 32.

**Simon & Schuster**
- ⋆⌐Star Trek/Kobayashi ... 27.

**Sir Tech**
- ⋆Wizardry ... 36.

**Spectrum Holobyte** *(reqs. CGA)*
- ⋆⌐Orbiter *(Shuttle simulation)* ... 27.
- ⋆⌐GATO ... 27.
- ⋆⌐Tellstar 2 *(search the skies)* ... 45.

**Subiogic** *(reqs. graphics brd.)*
- ⋆⌐Night Mission Pinball ... 29.
- ⋆⌐Jet ... 33.
- ⋆⌐Scenery *(airport)* disks for Jet ... *each* 15.
- ⋆⌐Japan Scenery Disk ... 15.
- ⋆⌐Star Scenery Disk—San Francisco ... $15.
- ⋆⌐Package of all 6 Western Airports ... 69.

**XOR** *(not copy-protected)*
- ⌐NFL Challenge *(be the coach)* ... 79.

## HARDWARE

Manufacturer's minimum limited warranty period is listed after each company name. Some products in their line may have longer warranty periods.

**AST Research ... 2 years**
- I/O Plus II C/S ... 119.
  Second serial, parallel or game port ... 35.
- SixPakPlus 64k C/S/P *includes Sidekick vers. 1.5 not copy-protected & DESQView* ... 169.
- SixPakPlus 384k *(fully populated)* ... 209.
- SixPakPremium 256k C/S/P *upgrades to 1 Meg on board, 2 Meg w/ opt. piggyback board; EEMS compatible, includes DESQView* ... 319.
- SixPakPremium Piggyback Board 256k ... 189.
- Flashpak *(accelerator board)* ... 369.
- ⌐Advantage 128k *upgradeable to 1.5 Meg includes Sidekick vers. 1.5 not copy-protected and DESQView* ... 369.
- ⌐Advantage Premium 512k S/P *upgrades to 1 Meg on board, 2 Meg w/ opt. piggyback board; EEMS compatible, includes DESQView* ... 469.
- ⌐Advantage Premium Piggyback Board 512k 289
- ⌐3780 ... 579.
- ⌐5251-11 ... 579.
- ⌐5251-11 Plus ... 639.
- RAMpage! 256k *upgrades to 2Mb* ... call
- ⌐RAMpage! AT 512k *upgrades to 2Mb* ... call
  *Both RAMpage boards support EMS and fully support EEMS, and include DESQView*

**Amdek ... 2 years**
- ⌐Video 310A mono monitor *(amber)* ... 159.
- ⋆⌐Color 600 - RGB ... 399.
- ⌐Color 722 - EGA compatible ... 519.

**Compucable ... lifetime**
- Plastic Keyboard & Drive Cover Set ... 15.
- ⌐IBM Mono Screen Enhancement ... 17.
- ⌐9-to-25 Pin Serial Converter cable ... 19.
- ⌐AT-to-Smartmodem cable ... 19.
- ⌐15-foot Parallel Printer cable ... 27.

*DATA TRANSFER SWITCHES (A-B switch boxes)*
- ⋆⌐2-Position ... 39.
- ⋆⌐3-Position ... 65.
- ⋆⌐4-Position ... 79.

**Cuesta ... 1 year**
*Uninterruptable power backup units.*
- ⋆Datasaver 200 Watt ... call
- ⌐Datasaver 400 Watt ... call

For the IBM-PC (XT & AT) *Exclusively.*

PC CONNECTION®

# It gave me great pain.

*There was so much to do!*
*How could I possibly see this list through?*
*When what to my wondering eyes should appear, but*
*PC Connection's number big, bold, and clear.*

**Curtis ... lifetime**
*ACCESSORIES*
★ Low Profile Tilt and Swivel Pedestal ..... $25.
PC Pedestal *(for IBM displays)* ..... 27.
★ Static Mat ..... 27.
Portable Pedestal *(for portable computers)* .. 36.
★ Printer Stand ..... 18.
System Stand *(for IBM-PC & XT)* ..... 19.
★ Universal System Stand ..... 25.
★ Crystal 150 Watt *(line conditioner)* ..... 123.
★ Crystal 300 Watt *(line conditioner)* ..... 159.
*CABLES*
Smartmodem-to-IBM Cable *(9 feet)* ..... 17.
Keyboard Extension Cable *(3 to 9 feet)* ..... 27.
Extension Cables for IBM Mono Display ... 33.
Color and Monochrome Extension cables .. 39.
Printer-to-IBM cable *(9 feet)* ..... 17.
*SURGE SUPPRESSORS*
★ Safestrip *(6 outlets)* ..... 21.
★ Diamond *(6 outlets)* ..... 29.
★ Diamond-Plus *(w/FAX & modem protection)* . 41.
★ Emerald *(6 outlets; 6 ft cord)* ..... 36.
★ Sapphire *(3 outlets; EMI/RFI filtered)* ..... 47.
★ Ruby *(6 outlets; EMI/RFI filtered; 6 ft cord)* ... 55.
★ Ruby-Plus *(w/FAX & modem protection)* .... 65.
★ Command Center ..... SPECIAL ..... 79.

**DCA ... 1 year**
Smart Alec *(5251 emulation board)* ..... 639.
Irma *(3270 emulation board)* ..... 729.
Irma Keyboard ..... 259.

**Epson ... 1 year**
★ EX-800 printer *(80 col , 300 cps)* ..... 499.
★ EX-1000 printer *(136 col., 300 cps)* ..... 699.
★ FX-85 printer *(80 col., 160 cps)* ..... 379.
★ FX-286 printer *(136 col., 200 cps)* ..... 529.
★ LX-86 printer *(80 col., 120 cps)* ..... 245.
★ LQ-800 printer *(80 col., 180 cps)* ..... 549.
★ LQ-1000 printer *(136 col., 180 cps)* .... special
★ LQ-2500 printer *(136 col., 324 cps)* ..... 1089.
★ 420i printer *(136 col., 420 cps)* ..... call
Printer-to-IBM cable *(6 feet)* ..... 15.

**Everex ... 1 year**
Evercom II 1200 Baud Internal modem *(half card, w/software)* ..... 137.

**5th Generation ... 6 months**
★ Logical Connection Print Buffer 256k ..... call

**FTG ... 2 years**
Light Pen ..... 195.
Demo Disk for Light Pen ..... 39

**Hayes ... 2 years**
★ Smartmodem 300 ..... 139.
★ Smartmodem 1200 ..... 389
Smartmodem 1200B *(w/Smartcom II)* ..... 349
Smartmodem 1200B *(no software)* ..... 319.
★ Smartmodem 2400 ..... 589.
Smartmodem 2400B *(w/Smartcom II)* .... 529.
Smartcom II 2.1 *(software)* ..... 89
Transet 1000 ..... $279
*N² cables for Transet 1000* ..... *each* 16.

**Hercules ... 2 years**
*All Hercules boards come with parallel port and FREE parallel printer cable.*
Hercules Color Card ..... 159.
Hercules Graphics Card ..... 189.
Hercules Graphics Card Plus ..... call
Graph X Software ..... 42.

**Intel ... boards: 5 years; chips: 1 year**
Above Board PC 64k *(upgrades to 2 Meg)* .. call
Above Board AT 128k *(upgrades to 2 Meg)* .. call
Above Board PS-PC C/S/P *(upgrades to 1.5 Meg)* ..... call
Above Board PS-AT S/P *(upgrades to 1.5 Meg or higher w/piggyback)* ..... call
8087 *(for IBM-PC & XT)* ..... 119.
8087-2 *(for 8 Mhz computers)* ..... 169.
80287 *(for 6 or 8 MHz IBM-PC AT & XT 286)* . 195.
80287-8 *(for 10 MHz & faster IBM-PC AT)* ... 269.

**Kensington Microware ... 1 year**
★ Masterpiece ..... 94.
★ Masterpiece Plus ..... 129
★ Printer/portable computer stand ..... 17.

**key tronic ... 90 days**
5150 keyboard ..... 115.
5151 keyboard *(deluxe)* ..... 169.
5153 keyboard with touch pad ..... 279.

**Kraft ... 1 year**
Joystick *(2 button)* ..... 27.
Joystick Adapter Card ..... 29.
*New!* 3 Button Joystick ..... 33.
Executive Cursor Control 2.0 w/joystick ... 37.
Game Port for AST SixPak/SixPak Premium . 25.

**Microsoft ... 1 year**
Microsoft Bus Mouse with software 6.0 .... 127.
★ Microsoft Serial Mouse with software 6.0 ... 135.
Mach 10 *(accelerator board)* ..... 369.

**Mouse Systems ... lifetime**
★ Junior Mouse with PC Paint 2.8 *(connects directly to PCjr serial port)* ..... 99.
PC Mouse with PC Paint+ ..... 127
Bus Mouse with PC Paint+ ..... 129.
PC Mouse with Dr. Halo II ..... 139.
PC Mouse with Ready and PC Paint+ .... 149.

**NEC ... 2 years**
Multisync monitor *(EGA compatible)* ..... call

**NSI Logic ... 3 years**
EPIC *(video adapter, EGA compatible)* .... $279.
Smart EGA ..... 299.

**Orchid Technologies ... 1 to 2 years**
Conquest Multifunction Board 0k *upgrades to 2Mb, fully supports EMS spec.* ..... 264.
Eccell Multifunction Board for the AT ..... 399.
Tiny Turbo 286 ..... 445.
PC Turbo 286e w/1 Meg ..... 739.
PC Turbo 286e Ram Daughtercard 1 Meg . 269.
Turbo EGA ..... 589.
EGA ..... 289.

**Princeton Graphics ... 1 year**
★ Text switch (green or amber) for HX-12 ..... 22.
MAX-12E Amber monochrome monitor ... 179.
★ HX-12 RGB monitor *(690 x 240)* ..... 449.
HX-12E *(EGA compatible)* ..... 539.

**Quadram ... 1 to 2 years**
Quadcolor 1 *(standard CGA card)* ..... 99.
Expanded Quadboard C/S/P
0k *(upgrades to 384k)* ..... 129.
384k *(fully populated)* ..... 179.
★ Microfazer Printer buffer 64k *(parallel)* ..... 159.
★ Microfazer II Printer buffer 64k *(expandable to 512k, selectable input/output modes)* ..... 249.
QuadEGA+ *(half-card)* ..... 349.

**SMA ... 30-day money-back guarantee**
PC-Docurnate Keyboard Templates *available for:*
DOS/Basic 3.0-3.1 — WordStar
Lotus 1-2-3 — WordStar 2000
Symphony — MultiMate
Framework — WordPerfect
dBase III ..... *each* 12.
*Some templates also available for Key tronics 5151 keyboard and IBM enhanced keyboard.*

**Toshiba ... 1 year**
*Toshiba printers are 24 pin dot matrix*
★ P321 S/P printer *(80 column, 216 cps)* ..... 519.
★ P351 S/P printer *(136 column, 288 cps)* ... 1049.
Toshiba T1100 PLUS Laptop Computer .... call
Toshiba T3100 Laptop Computer ..... call

**Tseng Labs ... 1 year**
EVA *(EGA card)* ..... 317.
EVA 480 *(supports 640x480 resolution, includes drivers for Lotus 1-2-3 ver. 1A)* ..... 399.

**Video 7 ... 2 years**
VEGA *(half-card)* ..... 329.
VEGA Deluxe *(w/FREE Microsoft Windows)* . 399.

## 1-800/243-8088


**PC Connection**
6 Mill Street
Marlow, NH 03456
603/446-3383


320M

## DRIVES

**I2 Interface ... 1 year**
20 Meg Hard Drive Card *(85 ms)* ..... 459.

**IOMEGA ... 90 days**
Bernoulli Box 20 Meg w/PC2 card ..... call
10 Meg cartridge ..... 51.

For the IBM-PC (XT & AT) *Exclusively.*

# PC CONNECTION®


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# Call 800/243-8088.

*I dialed that number. They got it all straight.*
*And I heard them exclaim as they resolved my poor plight,*
*"Happy Holidays to all, and to all*
*a good night."*

- Bernoulli Box 40 Meg w/PC2 card . . . . . $call
- Bernoulli Plus *(Two 20 Meg Bernoulli Drives w/80 Meg Winchester; includes PC2W card)* 3799.
  With PC 2BW Bootable Card . . . . . 3859.
- PC2B (Bootable) Card . . . . . 229.
  20 Meg cartridge . . . . . 67.
  Bernoulli Box Care Kit. . . . . 79.

**Mountain Computer ... 1 year**

- Drive Card 20 Meg *(80 ms)*. . . . . call
- Drive Card 30 Meg *(78 ms)*. . . . . call

**Seagate ... 1 year**

20 Meg Internal Hard Drive *(w/controller and cables, 65 ms)* . . . . . 389.
20 Meg Internal Hard Drive *(w/Western Digital controller and cables, 65 ms)* . . . . . 409.

- 20 Meg Internal Hard Drive for AT *(40 ms)*. 569.
- 30 Meg Internal Hard Drive for AT *(40 ms)*. 689.

**Tandon ... 1 year**

*New* Business Card *20* Meg *(85 ms)* . . . . . 409.

**TEAC ... 1 year**

PC, XT 360k Drive *(5¼" half-height, FD-55BV)* . . . . . 109

**Toshiba ... 1 year**

PC, XT 360k Drive *(5¼" half-height)*. . . . . 109.

- AT 360k Drive *(5¼" half-height)*. . . . . 117.

External Drive *5¼"* for Toshiba Laptops . . . call
Floppy Link for Toshiba Laptops. . . . . call

**Western Digital ... 1 year**

File Card 20 Meg *(w/XTREE, 80 ms)* . . . . . call

## MEMORY

64k Memory Upgrade Set for IBM-PC or XT system board or any memory board
150 nanosecond *(set of 9)* . . . . . 15.

- 128k Memory Upgrade Set for IBM-AT System Board *(9 chips piggybacked)*. . . . . 39.
- 256k Memory Upgrade Set for any IBM-AT memory board *(9 chips)* . . . . . 39.

## DISKS

All disks have a lifetime warranty.

**DS/DD Disks** for the PC & XT (40 TPI).

- ★ Verbatim Datalife *(10 disks per box)* . . . . . 15.
- ★ Maxell MD-2 *(10 disks per box)* . . . . . 19

**DS/High Density Disks** for the AT (96 TPI).

- Fuji *(10 disks per box)* . . . . . 27.
- Verbatim *(10 disks per box)* . . . . . 29
- Maxell *(10 disks per box)* . . . . . 34

**3½" Double-sided Diskettes** *(720k)*

Verbatim *(10 diskettes)* . . . . . 26.
Sony *(10 diskettes)* . . . . . 26.
MAXELL *(10 diskettes)* . . . . . 26
3M *(10 diskettes)* . . . . . 27.
BASF *(5 diskettes)*. . . . . 14.

## PC Connection Service Center

Did you know that we are an authorized Epson and IOMEGA service center? We typically offer twenty-four hour turnaround on serviced items. Our labor charge is only $25 per hour. Call 1-800-PCC-TECH extension 138 for a free telephone diagnosis.

## Junior Happiness

Christmas comes but once a year so our Jr. Specials now are here bringing joy to Juniors far and near

★ **Jr. Drive Kit** (includes Creative Firmware Drive IIA adapter, power supply and Control Data Floppy Drive) . . . . . $199.

**ALPHA SOFTWARE**

★ **Jr. Electric Desk** (includes word processor, database, spreadsheet, communications on 2 cartridges, one program disk and one tutorial disk) . . . $69.

**MOUSE SYSTEMS**

★ **Jr. Mouse w/PC Paint 2.8** (w/software and pad, reqs. 256k). . . . . $99.

**FINANCIAL SOFTWARE**

★ **Jr. Financier** (reqs. IBM BASIC cartridge) . . . . . $19.

**KEYTRONIC**

★ **Jr. 5151 Deluxe Keyboard** . . . . . $169.

## INFORMATION SERVICES

- ★ **Compuserve Information Service** *(includes subscription, manual, $25 usage credit, monthly publications)* . . . . . 24.
- ★ **Dow Jones** Membership Kit . . . . . 24.
- ★ **The Source** . . . . . 30.

## 1-800/243-8088

**PC Connection**
6 Mill Street
Marlow, NH 03456
603/446-3383

320M

CIRCLE 339 ON READER SERVICE CARD

## MISCELLANEOUS

**Automation Facilities**

- ★ Floppiclene Disk Drive Cleaner . . . . . $18.

**Environmental Software**

- Nylon Computer Covers PC, XT or AT *(navy, burgundy or silver)* . . . . . 20.

**Innovative Concepts**

- ★ Flip n' File 50 *(holds 50 disks)* . . . . . 16.
- ★ Flip Sort *(holds 70 disks)* . . . . . 15.

**PC Connection**

Computer Toolkit *(all the tools you need to go with your PC in a software style binder; great gift idea!)* . . . . . 29.
Clear Hard Plastic Keyboard Cover and Copy Holder *(PC & XT)*. . . . . 16.

## OUR POLICY

- We accept VISA and MASTERCARD.
- No surcharge added for charge orders.
- Your card is not charged until we ship.
- If we must ship e partial order, we never charge freight on the shipment(s) that complete the order.
- No sales tax.
- All U.S. shipments insured; no additional charge.
- APO/FPO orders usually shipped 1st Class Mail.
- Allow 1 week for personal and company checks to clear.
- UPS Next-Day-Air available.
- COD max. $1000. Cash or certified check.
- 120 day limited warranty on all products.*
- To order, call us anytime Monday thru Friday 9:00 to 9:00, or Saturday 9:00 to 5:30. You can call our business offices at 603/446-3383 Monday through Friday 9:00 to 5:30.

## SHIPPING

**Note:** Accounts on net terms pay actual shipping.

**Continental US:**

- For monitors, printers, and drives, add 2% for UPS ground. Call for UPS 2nd-Day & Next-Day-Air.
- For computers, pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add $2 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

**Hawaii:**

- For monitors, printers, and drives, actual UPS Blue charge will be added. For all other items, add $2 per order.

**Alaska and outside Continental US:**

- Call 603/446-3383 for information.

For the IBM-PC (XT & AT) exclusively.

# PC CONNECTION®

* DEFECTIVE SOFTWARE REPLACED IMMEDIATELY. DEFECTIVE HARDWARE REPLACED OR REPAIRED AT OUR DISCRETION. SOME ITEMS HAVE MANUFACTURERS WARRANTIES UP TO FIVE YEARS.

# PC Pastimes.

**The play's the thing.**

For years, industry fuddie duddies have been trying to figure out the extraordinary attraction of our industrious fuzzy wuzzies. How, they ask themselves, did a bunch of small tree-climbing carnivorous mammals manage to metamorphose the miniature maildrop of Marlow, NH (pop. 545) into a micro mail-order monolith?

Well, our masked mascots aren't too concerned with the secret of their success—they're too busy enjoying themselves. And so are we. Because helping you put together perfect PC systems (at superlative prices) is our idea of a good time.

**Everybody wins.**

We know it's no fun struggling late into the night with an obsolete program when you could be snuggling up to your favorite furry friend. Or tearing your hair out over some incomprehensible installation when you could be enjoying some innocent interlude. That's why we sell only the latest versions of products at the lowest prices, and make sure that you have everything you need to get up and running. We even have a special tech support number (1-800-PCC-TECH) staffed by perpetually positive-thinking pros who can make any set-up a pleasure.

**Get on the (joy) stick!**

We know there's nothing like taking a break from the Great American Novel or Ultimate Spreadsheet to indulge in a little light electronic amusement. So we're offering a free copy of our very own *PC Man and Hopper* to anyone who places a $500 order between now and March 31.

Just call 1-800/243-8088 or 1-603/446-3383, M-F 9:00 to 9:00; Saturday to 5:30. If you're planning to visit, call ahead to make sure what you want is in stock.

**Give your PC the bird—with *Hopper*. Together at last with *PC Man*, on one disk. Offer not available to net accounts. Limit one per customer.**

**For the IBM-PC (XT & AT) exclusively.**

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sired. Eleven Ctrl-key sequences are preprogrammed for common functions, but you can also program as many as 40 combinations of function keys.

In fact, the entire menu system is very easy to restructure. The menu design is stored in a simple ASCII text file that you can modify with any text editor or word processor, and the syntax for the on-screen commands is extremely easy and lucid. You enter coordinates with a mouse or a digitizer or by means of the keyboard. *EasyCAD* accepts absolute, relative, polar, or relative polar coordinates. (This last option, unique in the CAD programs I've reviewed to date, closely resembles LOGO turtle movement commands.)

Entities include the normal line, circle, and arc types as well as boxes, polygons, spline curves, and an unusual entity called a smooth polygon. A smooth polygon lets you create a curved object within it based on the shape its frame. You can enter text a line or a paragraph at a time, and you can specify the height and the angle at which the text will be drawn. You can also change the text font (two fonts are supplied: a simple, fast one and a more stylish but slower drawing font), but you can use only one font in any one drawing.

*EasyCAD* allows zooms by magnification or reduction, windowing, and center of interest. You can define four Views of an image and zoom directly to or plot any one but you can designate these Views only by number, not name. *EasyCAD* maintains up to 31 layers, with no restriction on entity color or line type within the layers. The program can hide any layer from view for faster redrawing.

Snap and Grid are offered, each with variable spacing but no aspect control (variable vertical and horizontal spacing). Since Snap and Grid spacings are independent, you can specify a reasonably coarse grid and finer snap resolution. Various forms of object snap are available, including endpoint, midpoint, quadrant of circles, center of an arc or circle, and a very interesting option that lets you specify a percentage of length along an entity. For example, you could snap directly to 75 percent (or ¾) of the distance along a line you select. *EasyCAD* also can draw parallel and perpendicular lines or lines related to another line by a specific angle.

## INVENTIVE EDITING COMMANDS

Several of the editing commands are unusual and inventive. Connect, as its name implies, connects entities, but it can also resize and rotate them. Change stretches entities. Rotate and Scale work very smoothly and flexibly. Repeat creates rectangular (but not circular) arrays, Mirror works at any angle and can also copy as it mirrors, and the very flexible Break, Bend, and Trim commands let you control line lengths and object shapes very easily, even after you've already drawn them. Fillet commands work predictably (unlike in some CAD programs) but only on straight lines, not arcs or circles.

Overall, *EasyCAD*'s editing facilities are very good, especially for a product in this price range, but there's one major fly in the ointment. *EasyCAD* doesn't provide a way to recover from an incorrect or inadvertent erasure other than through a cumbersome reconstruction of the entire drawing. What aggravates this problem is that picked entities are not highlighted, so you can't be sure that you've picked a given entity successfully or that all the entities you select will be included in an erasure (or any other action, for that matter).

*EasyCAD* handles the process of creating parts (blocks)—as well as saving them to disk and inserting them into other drawings—very well. It lets you specify the correspondence between a drawing unit and feet, inches, meters, or millimeters, and you can specify how many such units you want displayed. *EasyCAD* automatically converts units when a part is inserted; for example, a 24-inch-wide chair is inserted at 2 units wide if feet are the current units. Using drawing units makes it very easy to draw parts to real-world measurements and insert them at the appropriate size into other drawings.

Very good screen reports let you examine the parameters of the current drawing, system utilization, and entity characteristics. Directories of drawings and other relevant file types are available, but there isn't any direct access to DOS.

An external program, rather than *EasyCAD* itself, handles plotting. You can choose to plot any of the four possible user-defined views, the current view (when you last saved the image), or the entire drawing. You choose the font for text

### PC MAGAZINE CAD Software: Summary of Features

| | CADWrite | AutoSketch | EasyCAD | MicroCadam |
|---|---|---|---|---|
| **Entity Drawing Commands** | | | | |
| Line | ● | ● | ● | ● |
| Wide lines | ○ | ○ | ○ | ○ |
| Parallel lines | ● | ○ | ● | ○ |
| Point/node | ○ | ● | ● | ● |
| Circle | ● | ● | ● | ● |
| Arc | ● | ● | ● | ● |
| Ellipse | ● | ○ | ○ | ● |
| Multipoint curve | ● | ● | ● | ● |
| Rectangle | ● | ● | ● | ○ |
| Square | ○ | ○ | ○ | ○ |
| Polygons | ● | ● | ● | ● |
| Solid areas | ● | ○ | ○ | ○ |
| Text | ● | ● | ● | ● |
| Centering | ● | ○ | ○ | ● |
| Auto-aligned | ○ | ○ | ○ | ● |
| Font changes | ○ | ○ | ● | ○ |
| Rotation | ● | ● | ● | ● |
| **Drawing Assistance** | | | | |
| Snap | ● | ● | ● | ● |
| Variable sizing | ● | ● | ● | ● |
| Aspect | ○ | ● | ○ | ● |
| Rotation | ○ | ○ | ○ | ● |
| Isometric | ○ | ○ | ○ | ○ |
| Angle | ○ | ○ | ○ | ● |
| Align | ○ | ○ | ● | ● |
| Grid | ● | ● | ● | ● |
| Variable sizing | ● | ● | ● | ● |
| Aspect | ○ | ● | ○ | ● |
| Axis | ○ | ○ | ○ | ○ |
| Orthogonal mode | ○ | ● | ● | ● |
| Object snap | ● | ● | ● | ● |
| Nearest | ○ | ○ | ● | ● |
| Endpoint | ● | ● | ● | ● |
| Midpoint | ○ | ● | ● | ● |
| Center of circle | ● | ● | ● | ● |
| Node/point | ○ | ● | ● | ● |
| Quadrant of circle | ○ | ● | ● | ○ |
| Intersection | ● | ○ | ○ | ● |
| Perpendicular | ○ | ○ | ● | ● |
| Tangent | ● | ○ | ○ | ● |
| Polar | ○ | ○ | ○ | ○ |
| **Editing Commands** | | | | |
| Selection | ● | ● | ● | ● |
| Individual objects | ● | ● | ● | ● |
| Groups of objects | ● | ● | ● | ● |
| Windows | ● | ● | ● | ● |
| By entity type | ● | ○ | ○ | ● |
| Erase | ● | ● | ● | ● |
| Unerase | ● | ● | ○ | ● |
| Move | ● | ● | ● | ● |
| Copy | ● | ● | ● | ● |
| Mirror image | ● | ● | ● | ● |
| Rotation | ● | ● | ● | ● |
| Resizing | ● | ● | ● | ● |
| Layer change | ● | ● | ● | ● |
| Area fill | ● | ○ | ○ | ○ |
| Intersection fix | ● | ○ | ○ | ● |
| Break/trim | ● | ● | ● | ● |
| Lines | ● | ● | ● | ● |
| Circles/arcs | ● | ● | ● | ● |
| Fillet | ● | ○ | ● | ● |
| Chamfer | ● | ○ | ○ | ● |
| Arrays | ● | ○ | ● | ○ |
| Rectangular | ● | ○ | ● | ○ |
| Circular | ● | ○ | ○ | ○ |
| Segment line/arc | ○ | ○ | ○ | ● |
| **Layers** | | | | |
| Maximum number | ∞ | 10 | 31 | N/A |
| Named layers | ● | ○ | ○ | N/A |

●—Yes ○—No ∞—Infinite N/A—Not applicable

Note: Yes responses designate direct commands, or primitives, only; for example, indirect drawing of a square or ellipse was not given a Yes rating.

## CAD Software: Summary of Features

| | CADWrite | AutoSketch | EasyCAD | MicroCadam |
|---|---|---|---|---|
| **Inquiry Commands** | | | | |
| Lists characteristics | ○ | ● | ● | ● |
| Calculates distances | ● | ● | ● | ● |
| Calculates areas | ● | ● | ● | ○ |
| Calculates volume | ○ | ○ | ○ | ○ |
| Calculates moments, etc. | ○ | ○ | ○ | ○ |
| **Display Controls** | | | | |
| Zoom | ● | ● | ● | ● |
| Magnification factor | ● | ● | ● | ● |
| Window | ○ | ● | ● | ● |
| Nesting return | ○ | ● | ● | ● |
| Pan | ● | ● | ● | ● |
| Visible coordinates | ● | ● | ● | ○ |
| Change unit base | ● | ○ | ● | ● |
| Named views | ● | ○ | ○ | ○ |
| Solid fill control | ● | ○ | ○ | ○ |
| Object dragging | ○ | ● | ○ | ○ |
| Isometric drawing | ● | ○ | ○ | ○ |
| Cross-sectioning | ○ | ○ | ○ | ○ |
| Projections | ● | ○ | ○ | ● |
| **Blocks** | | | | |
| Definition from active file | ● | ● | ● | ● |
| Size scaling on insertion | ● | ● | ● | ○ |
| Rotation on insertion | ● | ● | ● | ● |
| **Dimensioning** | | | | |
| Linear | ● | ● | ● | ● |
| Angular | ● | ○ | ○ | ● |
| Diameter | ● | ○ | ○ | ● |
| Radius | ● | ○ | ○ | ● |
| Extension lines | ● | ○ | ○ | ● |
| Tolerances | ● | ○ | ○ | ● |
| Leaders | ● | ○ | ○ | ● |
| Center marks | ○ | ○ | ○ | ● |
| Horizontal | ● | ● | ● | ● |
| Vertical | ● | ● | ● | ● |
| Aligned | ● | ● | ● | ● |
| Rotated | ● | ○ | ○ | ● |
| Baseline | ○ | ○ | ○ | ● |
| Continue/chained | ○ | ○ | ○ | ● |
| **Hatching** | | | | |
| Number of patterns supplied | None | None | None | None |
| User-defined patterns | ● | ○ | ○ | ○ |
| Hatching styles | ○ | ○ | ○ | ○ |
| **Attributes** | | | | |
| Visible/invisible | ○ | ○ | ○ | ○ |
| Editable | ○ | ○ | ○ | ● |
| **Help** | | | | |
| On-screen | ○ | ○ | ● | ○ |
| Context sensitive | ○ | ○ | ○ | ○ |
| **Plotting Controls** | | | | |
| Variable sizing | ● | ● | ● | ● |
| Pen speed control | ○ | ● | ○ | ○ |
| Pen force control | ○ | ○ | ○ | ○ |
| Pen acceleration control | ○ | ○ | ○ | ○ |
| Plot rotation | ● | ● | ○ | ● |
| Automatic scaling | ○ | ○ | ● | ● |
| Exact scaling | ● | ● | ● | ● |
| Spooling | ○ | ○ | ○ | ○ |
| Plotter optimization | ○ | ○ | ● | ○ |
| **Miscellaneous Commands** | | | | |
| Command scripts | ○ | ○ | ● | ○ |
| Slide shows | ○ | ○ | ○ | ○ |
| Programming language | ○ | ○ | ● | ○ |
| User-defined screen menus | ○ | ○ | ● | ○ |
| Tablet menus | ○ | ○ | ○ | ○ |
| Freehand sketching | ● | ○ | ○ | ○ |
| 3-dimensional presentation | ○ | ○ | ○ | ○ |

●—Yes ○—No ∞—Infinite N/A—Not applicable

Note: Yes responses designate direct commands, or primitives, only. for example, indirect drawing of a square or ellipse was not given a Yes rating

here (you can save time during image manipulation by choosing the default font and still obtain more elegant lettering by selecting the fancier font when plotting). Plots can be scaled in several ways to obtain exact-scale hard copy. Depending on the plotter, you can select options for paper size, orientation, and other factors.

*EasyCAD* performs semiautomatic linear dimensioning, as do many other CAD programs, but with one marvelous twist called associative dimensioning. If you use an editing command to lengthen or shorten a line that is dimensioned, the dimension automatically changes to reflect the new length (*AutoSketch* also has this feature). Unfortunately, *EasyCAD* doesn't dimension circles or angles or do baseline or continuation dimensioning. These deficiencies are significant for many kinds of mechanical and architectural applications.

**VERSATILE MACROS** *EasyCAD* includes a macro programming language that lets you develop programs for data acquisition from the operator, perform various calculations, and control drawing and editing operations. The macro system assigns values and coordinates to function keys rather than named variables, which seems curious at first but has some interesting implications for interactive applications. The macro system uses simple two-letter command abbreviations, and learning the system is quite a bit easier than in the many other CAD programs that model their macros after a high-level language like C, BASIC, or LISP. *EasyCAD*'s macro provisions are not nearly as complete as those in some competitive programs, but they're easy to learn and use and are surprisingly versatile.

The documentation for *EasyCAD* is very good. A twelve-lesson tutorial grounds you thoroughly in most commands and options, and a reference section and appendices cover everything in lucid detail. On-line help is also available.

Other utilities convert *EasyCAD* drawings to or from *VersaCAD* or *AutoCAD* format or to a special *EasyCAD* drawing exchange format. Generally, the conversions are complete, although some of the more esoteric entities on either side of the equation may not be converted at all. Still other utility programs scan and analyze *EasyCAD* or *VersaCAD* drawings.

*EasyCAD* lacks several features that may be important to many potential users. Perhaps the most significant is the lack of wide lines and curves: it has no means to display or plot lines that require anything other than a normal pen width. In addition, it does not support hatching, and solids, area fill, chamfers, free-form sketching, and attribute tagging are nowhere to be found.

According to *EasyCAD*'s author, most of these omissions were made on purpose. Next to the business environment, one of *EasyCAD*'s prime marketing targets is the educational market. Commercial users may have full-blown and costly hardware,

■ *EasyCAD* includes a macro programming language that lets you develop programs for data acquisition.

but educational institutions are often much more restricted in terms of hard disk storage, memory, and peripherals. Since *EasyCAD* stores to disk rather than storing everything in memory, it runs happily (albeit somewhat more slowly) in as little as 256K bytes without imposing any limitation on drawing size other than disk capacity. Similarly, *EasyCAD* is perfectly usable on a floppy-disk–based system. The author intends to release a high-end system later this year that will include most of the missing elements.

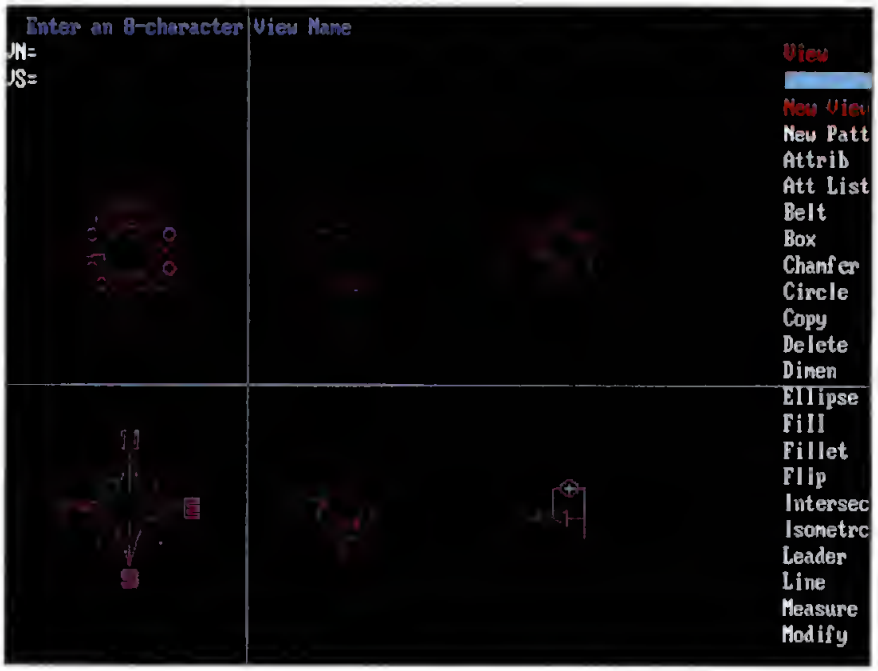
While not exactly an ugly duckling, *EasyCAD* won't wow you initially. The screen looks rather plain, especially compared to the sexy screen stylings of programs like *Drafix* and *RoboCAD*. The real beauty of *EasyCAD* lies below the surface. You have to use the program a while before the ease and the speed of the interface, the flexibility of the editing commands, and its other appealing aspects begin to enchant you. *EasyCAD* is a solid performer at an attractive price.

# CADWrite

*CADWrite*, a new release from IBM Corp., is originally derived from *FastDraft*, a CAD system marketed by IBM from 1982 to 1985 for the Series 1 mainframe system. *FastDraft* was ported to the IBM PC family and customized for that hardware environment and the PC-DOS operating system.

The hardware requirements specified for *CADWrite* include all IBM-brand devices except for mice (IBM doesn't currently offer a mouse). Obviously many other video adapters, monitors, printers, and plotters are compatible, but IBM chooses not to help in this area. Neither Hercules monochrome graphics nor any higher-resolution video systems are supported. IBM further discourages experimentation with third-party peripherals by not including any cabling or interface documentation.

*CADWrite* uses the Virtual Device Interface (VDI) standard for linking the various peripherals it supports. VDI is a real advantage in terms of flexibility, because drivers for many other devices are available from third-party sources. Early versions of VDI earned a reputation for sluggishness, but the newest release handles its chores reasonably expeditiously.




*With CadWrite's "semi-automatic" isometric system, you draw the top and side views of an object, and the program projects them into a completely accurate isometric view.*

*CADWrite* isn't copy protected, and a simple batch file copies it onto your hard disk. The main *CADWrite* program is so large (about 850K bytes) that you need DOS's RESTORE command to retrieve it from the floppy disk during installation. Unfortunately, the VDI system requires you to edit CONFIG.SYS to install the necessary drivers. IBM's documentation, which is otherwise excellent, is badly flawed in this area. I doubt that very many users of what is billed as an "entry level" program are going to be able to configure the system correctly (even dealers or "experts" will find it tough sledding). IBM should include some form of interactive program to manage the configuration complexities.

**ALPHABETICAL MENU** *CADWrite* uses a monolithic menu design rather than the multiple, hierarchical menu structure that most competitive CAD programs use. The *CADWrite* menu is simply an alphabetical list of the available commands, split into two halves; a function key switches you from one part to the other. This design lets you locate a given command with fewer picks than a tree-structured menu would require, but it also means that similar commands aren't grouped together.

Once you've chosen the command you want, the program prompts you at the top of the screen for whatever data it needs. You can specify initial coordinates with the pointing device or from the keyboard; subsequent points are usually entered from the keyboard in Delta Mode, meaning that you specify the change in *x* and *y* coordinates for the next point. Sometimes this method is more convenient than entering all absolute coordinates, sometimes it isn't. A choice of entry methods would be better.

Various options appear on the prompt line when appropriate. Some can be chosen with the pointer, while others are invoked with function keys. This characteristic can be confusing initially but becomes familiar quickly. There is no text cursor throughout the program's operation, an idiosyncracy that stays confusing.

*CADWrite* uses a free-roaming graphics cursor rather than locking the cursor to the snap grid, which some users find dis-

## PC MAGAZINE FACT FILE

***CADWrite***
IBM Corp.
6300 Digital Hwy.,
Dept 597/023
Boulder, CO 80302
(303) 924-9728
**List Price:** $1,995
**Requires:** 512K RAM, 1 hard disk drive, 1 floppy disk drive, DOS 2.1 or later for PC and PC-XT, DOS 3.0 or later for PC AT, 8087 math coprocessor for PC or XT, 8287 math coprocessor for AT, Enhanced Graphics Adapter card to support IBM monochrome, color, and enhanced graphics display, Professional graphics adapter card to support professional graphics display.
**In Short:** A resonably full-featured CAD program that falls between low-cost CAD programs and the heavyweights in terms of both cost and capabilities. The documentation is first-rate, and the dimensioning capabilities are more extensive than those of many of the competitors; some major subsystems are missing though. Not copy protected.

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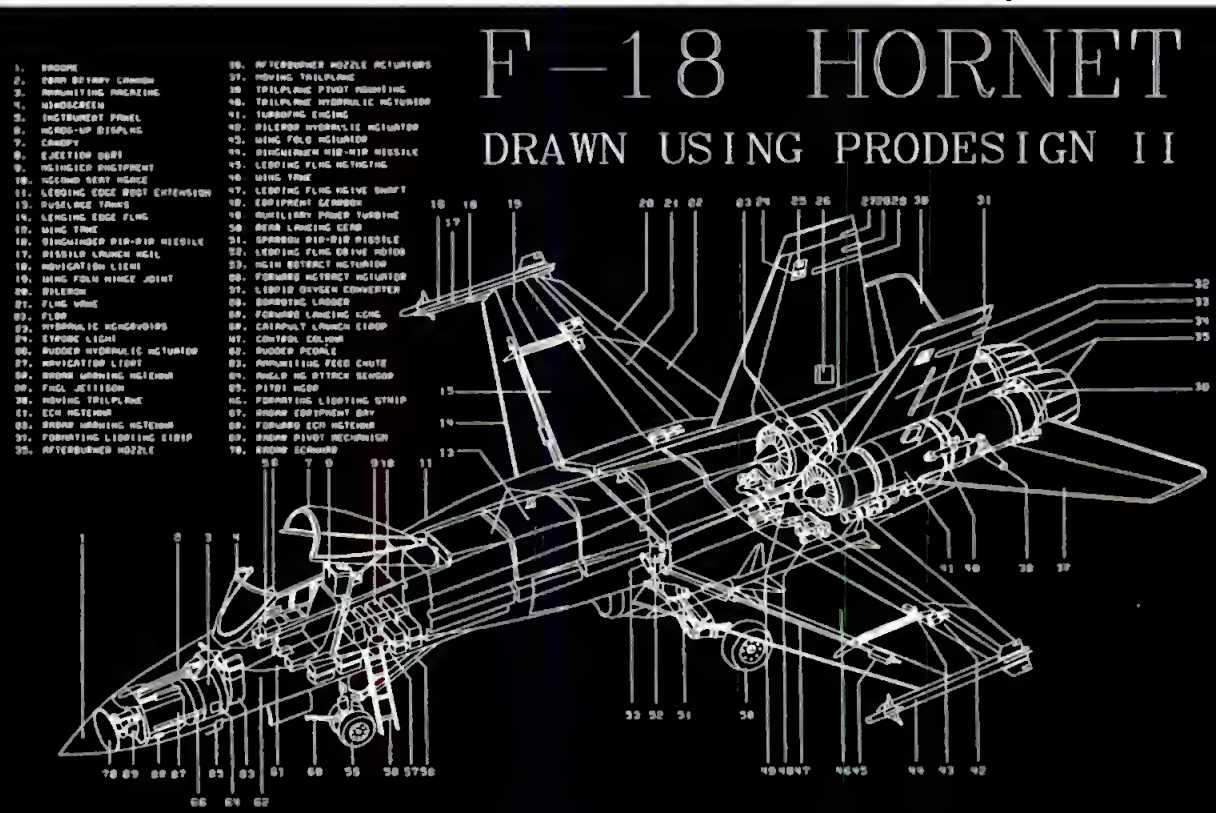



CIRCLE 475 ON READER SERVICE CARD

concerting but others prefer. The visible grid is also equivalent to the snap grid, which is somewhat less flexible than independent snap and grid sizing. A few other oddities in the user interface include the lack of highlighting to show how long responses can be, the absence of any directory facility (you must remember all relevant filenames), no on-line help, and a rather limited attribute tagging system.

Despite all these quibbles, the overall feel of the interface is agreeable. The interface depends on the keyboard more than I prefer, but you can learn to navigate through the system's options faster than with many other CAD programs.

**GOOD FEATURE SELECTION** The picture gets brighter still when you tally what features *CADWrite* includes. These consist of such unusual items as both open and closed belts, spirals, and splines as well as the normal lines (17 types, including useful line terminator symbols), circles, arcs, ellipses, boxes, and polygons. Free-form sketching is available, too.

Provision for editing drawings are comprehensive and flexible, including copy, delete, fill, excellent intersection trimming, both fillet and chamfer, offset parallel lines, repeat (for rectangular and circular arrays), cross-hatching, and more. Objects can be flipped, moved, rotated, and scaled, and panning and zooming work well. And you can adjust an extended list of system defaults.

*CADWrite* employs the concept of "scope" to encompass points, lines, shapes, patterns, and views. This interesting scheme lets you manipulate groups of entities in efficient and creative ways, manage different views of the same drawing (this feature can be used for level control), incorporate external images, and more. *CADWrite* also has automatic object snap to help you locate points and objects very easily.

*CADWrite* allows you to size text in several ways, but it limits you to only one font per drawing. *CADWrite* imports text from external text files, a capability that costs extra or isn't possible at all with some CAD programs. *CADWrite* lets you insert special text characters commonly used in mechanical drawing by using the high-order character set, which you access with the numeric keypad.

The very good *CADWrite* dimensioning system is easy to use, fast, and quite complete. The program's dimensioning capabilities are more extensive than those of many competitive programs, especially in circle and arc measurements. The only significant omissions are baseline and continuation dimensioning (which can be performed manually).

*CADWrite* comes with three very large symbol libraries: one each for inch, fractional, and metric units. More than 1,900 symbols are available, ranging from mechanical parts to trees, furniture, and doors. The mammoth symbol libraries that *CADWrite* can manipulate are a significant advantage, although you must extract the symbols by number, with no way of knowing which is which without referring to the manual.

■ *CADWrite* imports text from external text files, a capability that costs extra or isn't possible with some CAD programs.

*CADWrite*, like most microcomputer CAD programs, is a two-dimensional system. It does include an interesting semi-automatic isometric system: you draw the top and side views of an object, and the program then projects them into an accurate isometric view). While you can't draw directly in isometric mode, the trade-off is that the projection is completely accurate and can be used for checking clearances and other demanding tasks.

*CADWrite*'s plotter and printer control is better than most. You can map pens, adjust scaling and offset, or plot only the displayed image. You can't control pen acceleration, speed, or downforce, but many other microcomputer CAD programs don't let you control these parameters either.

A few major subsystems are missing. There's no macro system or programming language, for example. IBM encourages third-party software support through detailed, public specification of the database storage conventions in *CADWrite*, although only IBM can change the actual functioning of the program. Another weakness is the lack of both on-screen and plotted wide lines. IBM suggests using pens with wider tips for specified entities, but this solution is not satisfactory in many circumstances.

**FIRST-RATE DOCUMENTATION** *CADWrite*'s documentation deserves special commendation. Two volumes of clearly written and well-produced tutorial and reference material are a cut above most of the competition. The 15-lesson tutorial is a model for helping a new user learn to use a complex applications program. The documentation has a few errors and a few omissions, most notably the lack of any discussion of peripheral interfacing already mentioned, but in general *CADWrite*'s manuals are first-rate.

*CADWrite* has some lovely, capable features and concepts that place it fully in the mainstream of microcomputer CAD programs. Some of the missing functions may deter specific users, but what is included works well.

I'm not totally convinced by IBM's marketing position for the product, though. The company is positioning *CADWrite* as an entry-level CAD program that "can be used by those with little or no CAD expertise." IBM is also marketing *MicroCadam*, a scaled-down version of its large-system CAD program that sells for a staggering $8,000 (see following review), and perhaps IBM is trying to draw a meaningful distinction in positioning *CADWrite* at the lower end of the microcomputer software market.

*CADWrite* is a reasonably full-featured CAD program that requires an investment of time and energy commensurate with its complexity. In a market populated by an increasing number of inexpensive but competent CAD programs like *Drafix*, *EasyCAD*, *Generic CADD*, and others, *CADWrite* falls between these low-cost programs and the microcomputer heavyweights like Version 2.5 of *AutoCAD* and the fine new Version 5.0 of *Versacad* in terms of both cost and capabilities.

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CIRCLE 507 ON READER SERVICE CARD

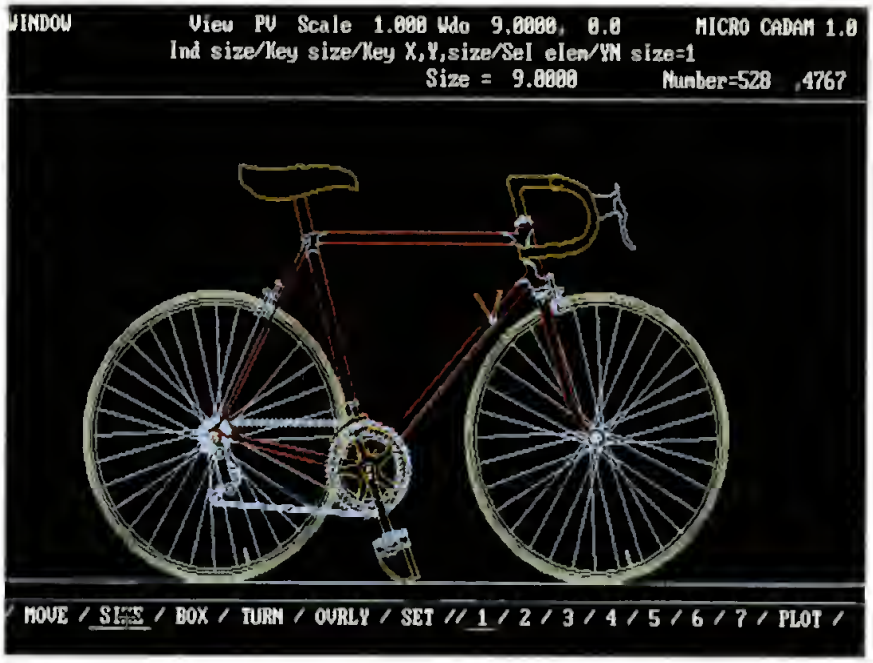
# MicroCADAM

Is any single PC program worth $8,000? That's the ticket for *MicroCadam*, the microcomputer version of the mechanical-drawing–oriented CAD program that is one of the most successful large system CAD programs in history. How does it stack up against less costly microcomputer CAD alternatives? Not badly at all.

Developed by CADAM INC. and marketed by IBM Corp., the system comes with a 32-function-key keypad sized to match the PC keyboard, a Mouse Systems optical mouse, and a special asynchronous interface board to which both peripherals connect. Each active button on the keypad has a bright-green LED; the overall effect is reminiscent of *War of the Worlds*.

*MicroCadam*—ten disks worth of software—is not copy protected. Instead, the function-key box incorporates a ROM that the software checks. You can make as many backups of the software as you wish, but there isn't any way to run the program on more than one computer at a time. The end result is similar to the hardware keys that *AutoCAD* and some other CAD programs now use, but there's less chance for interference with other programs since the protection device doesn't use one of the computer's normal serial or parallel ports.

Using EDLIN, you must edit both the CONFIG.SYS and the AUTOEXEC .BAT file to select the video device and plotter or printer in your system, a process that is carefully explained. This step could easily be automated, though.




*You can define seven numbered sets or views of a drawing using* MicroCadam's *zooming. You can also rotate the window view and lay one drawing over another to check for parts clearances.*

Hardware support is surprisingly limited. The program allows use of only the IBM PGA or EGA card or the high-priced IBM GGX display. The Hewlett-Packard and the IBM equivalents, the Houston Instrument, and the excellent Bruning Zeta 8 are the only plotters it supports, and you can use only Epson MX-80/100, HP ThinkJet, IBM Graphics, and Okidata 84/92/93 printers. No laser printers, no high-resolution video, no Calcomp plotters—the selection is relatively limited, especially considering the price. A math coprocessor and 640K bytes of memory are mandatory.

*MicroCadam* uses four lines at the top of the screen and two at the bottom for messages and prompts. This design forces your eyes to jump around the screen quite a bit. In spite of consuming a quarter of the screen, much of the text is abbreviated, even where there's room for full words (listing all the abbreviations takes six pages in the manual).

You select major command groups by using the function-key box. Submenus appear at the bottom of the display and change for each command group. Integration with the PC family is only fair. For example, only the F3 key on the PC keyboard is used (it redraws the screen). Similarly, no more than a couple of the PC's numeric keypad keys can be used, and then only occasionally. In several instances the PgUp key and the PgDn key should have been available for use. These procedures date back to mainframe and minicomputer versions of *MicroCadam*. One of the design goals for the microcomputer version was compatibility; a mainframe *CADAM* user can sit down at a PC and do everything in *MicroCadam* in the same way. This approach has its advantages, but it doesn't make full use of the PC's capabilities.

The mouse is a 100-step-per-inch model and feels sluggish if you're used to a 200-step mouse. On the other hand, its three buttons are put to good use: the left button selects commands or objects, the center button indicates approximate screen locations, and the right button, defined as Yes/No, is used to choose options or to confirm various actions.

The *MicroCadam* file management system is also rooted in mainframe techniques. Images are stored within special

PC MAGAZINE FACT FILE

*MicroCadam*
(Developed by CADAM INC.)
IBM Corp.
Old Orchard Rd.
Armonk, NY 10504
(914)765-1900
**List Price:** $8,000
**Requires:** 640K RAM, 20-Mbyte hard disk drive, DOS 3.0 or later.
**In Short:** An extremely powerful and comprehensive CAD program that is not too difficult to learn, despite its clumsy interface. Its high price will probably deter most users, but those who need compatibility for use with the mainframe version will love it. Not copy protected.

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## AT jr. $599.

This feature-packed model has an Intel 8088-2 running at 4.77MHz or 8MHz, selectable—many times faster than the IBM PC/XT®. Also has a "0" wait state on memory, and provides 640 KB of RAM on the mother-board. Offers eight expansion slots, an LED indicator for the turbo mode, and a key lock. Optional features include a hard disk, up to 40 MB (38 ms), EGA, and an 8087-2 math co-processor.

**Says PC Magazine, October 14:**
**"AT jr. earned the lab staff's praise for... construction quality."**

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CIRCLE 508 ON READER SERVICE CARD

*MicroCadam* files, not as separate DOS files, and are collected into groups and subgroups called user files. You can mark files as read-only and protect them with passwords if you wish.

**FOUR DRAWING GROUPS** *MicroCadam* has four drawing groups: points, lines, circles, and splines. Points play a much larger role in *MicroCadam* than in most microcomputer CAD programs because they are needed for drawing many objects, and the program creates points during some operations (*MicroCadam* even includes a special command to erase all points). You can create points at specified distances along an object, or you can divide objects into any number of segments. You can also create Unlimited Lines that extend infinitely in both directions and are very useful in mechanical constructions.

Several very powerful line drawing commands let you draw lines tangent to circles, arcs, and ellipses as well as conventional perpendicular lines and others very easily. There's no parallel line primitive, but the program can draw parallel lines in multiple steps.

*MicroCadam* also draws splines and smooth curved lines by connecting dots you've already placed on the drawing. It can also connect dots with straight-line segments, like a line chart. You're able to create splines that approximate conic sections, too.

*MicroCadam*'s grid system is unusual and powerful. You define the grid spacing (which can be different along the *x* and the *y* axes) and the extent of the grid. Unlike that of most CAD programs, *MicroCadam*'s grid need not extend over the entire drawing surface. Even more interesting, you can specify the individual spacing of the grid; it doesn't have to be regular. You can also align the grid to a specific point in the drawing.

Snap is linked to the grid points; you can't have differing snap and grid locations. Color is also used as a display aid; you can speed up redrawing by using color to isolate objects or exclude them from the drawing.

Zooming is specified by a window or a magnification-reduction factor. No "rubberbanded" box shows the window area as you choose it. You can define seven numbered sets or views of the drawing and return to any of them directly. Two unusual options let you rotate the window view and overlay a second drawing on top of the current one to check for parts clearances.

**IMPRESSIVE EDITOR** Editing provisions are also impressive. Both fillet and chamfer are available, and fillet works with circles as well as straight lines. *MicroCadam* can create concave, convex, and "pigtail" fillets (useful for numerical control templates). The Offset command duplicates lines, circles, arcs, ellipses, and splines at the distance and in the direction you specify.

■ *MicroCadam*'s grid system is unusual and powerful. You define the grid spacing and the extent of the grid.

*MicroCadam*'s excellent Relimit command combines the functions of Trim, Extend, and Break. Objects can be lengthened or shortened to selected elements if you wish. You can shorten circles to arcs or extend arcs to circles, and you can break or join elements. With a minimum of fuss, Relimit lets you perform actions that would require a lengthy series of commands in other CAD programs.

Grouping allows you to manipulate multiple objects simultaneously. It's unusually flexible in the way it selects entities, and you can make additions and deletions to the group interactively. In some cases the group can be used for only one editing operation, while other operations don't break the group down. Many editing commands fall under the Group function, but this programming decision doesn't seem particularly logical.

The program's Mirror provision works very well. You can even reflect or flip objects or groups across two mirror lines (to create a multiple-part object in fewer steps). Translate can Pivot, Move, Modify, Turn, or Scale objects or groups.

Another interesting concept is a "detail page." Up to 64 detail pages are associated with the main (primary) page, and each page stores some geometic details that can be inserted into the primary view either directly (in which case the individual components can be edited) or as a "ditto" or image. The ditto takes up much less storage, but it can be manipulated only as an entity. If a change is made to a detail page, the changes ripple through to wherever the detail has been dittoed. This feature can be exceedingly useful when making wholesale changes, but it also can be dangerous if not used correctly.

*MicroCadam* also includes a comprehensive symbol management system that lets you build multiple libraries of symbols and insert them with scaling, rotation, and solid fill; however, the two primitive hatching patterns (fills and hatches) show only when plotted. Predefined arrows, equilateral triangles, rectangles, rivets, dots, balloons, deltas, and section line arrows are included.

*MicroCadam*'s Analysis function calculates distances and angles but not areas, perimeters, or any mechanical calculations like radii of gyration, moments of inertia, and the like. Given the mechanical drawing orientation of *MicroCadam*, this omission seems rather serious.

*MicroCadam* is a 2½-D program. While it has no true 3-D capabilities, it includes a very proficient projection system that lets you create multiple, dimensionally accurate views. These views can be orthographic, true, or isometric. Various tools reduce the amount of drawing necessary for each view by projecting objects from other views. Learning these features and visualizing the cubic views that represent the real objects are not easy (or, more probably, I am too strongly rooted in 2-D CAD ), but *MicroCadam*'s tools are powerful and efficient.

**SUPERB DIMENSIONING** The *MicroCadam* dimensioning system is simply superb—the best I have yet seen on a microcomputer CAD program. The list of dimensioning options is comprehensive and includes such niceties as the length of a curve and chamfer dimensioning as well as

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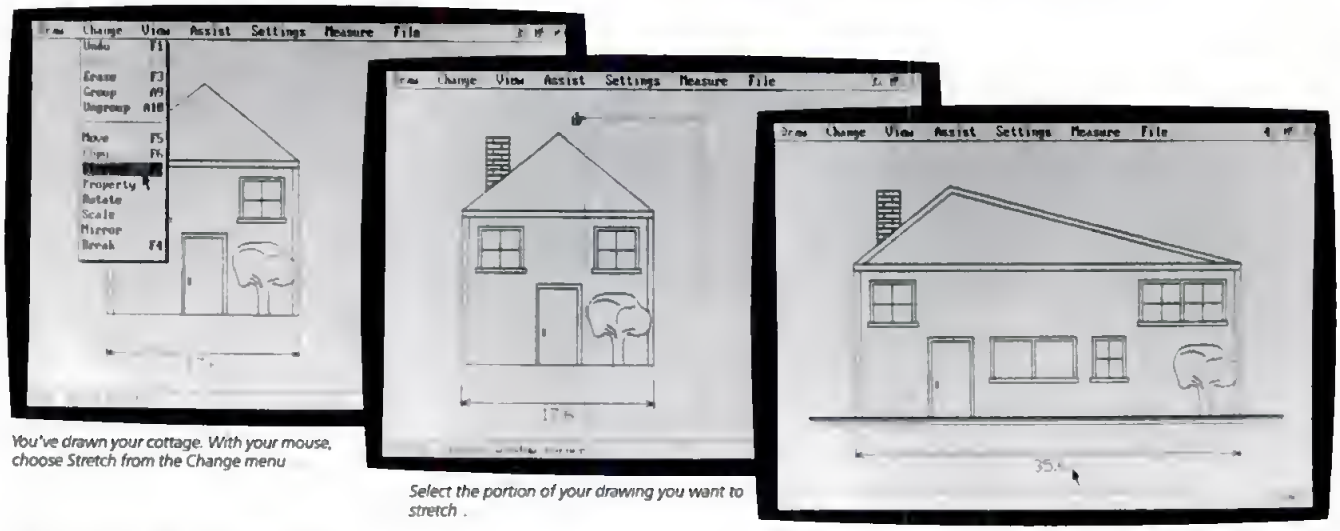

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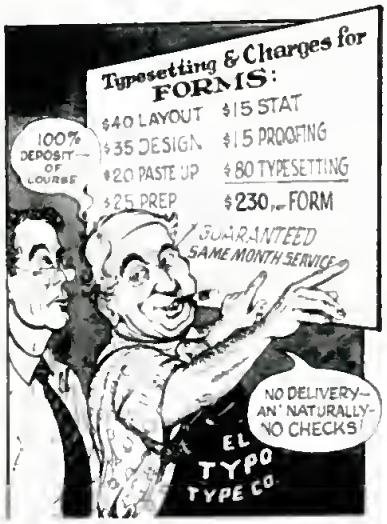


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## ■ COMPUTER-AIDED DESIGN

the normal linear and angular dimensioning, baseline/continuation, and much more. Dimensions can be moved with the mouse before their positions are finalized, various dimension characteristics can be changed readily, and so forth. *MicroCadam* supports both ANSI and ISO dimensioning standards.

The program's text facilities are good but not exceptional. Text size is adjustable, although if any size other than the two preset sizes is specified, memory consumption mounts severely. You can edit, move, copy, and scale text as well as justify it horizontally and vertically. On the other hand, *MicroCadam* offers only one text font and no method of importing text from external text files.

*MicroCadam*'s attribute system is limited and not terribly useful. You can assign a string of text to an entity and then edit, recall, and delete it, but that's about all. You can't choose to display or hide the text, define multiple attributes, or extract the data, for example, for a materials bill.

To plot an image, you define the area to be plotted by drawing a vertical and horizontal line adjacent to the desired area. Plotting itself is handled from within a separate program called from DOS rather than from within *MicroCadam*. No batch mode, control of plotter pen speed, acceleration or downforce, and other niceties are available.

The two-volume documentation is appropriate for a heavyweight—16 pounds worth! The tutorial is superb, even better than *CADWrite*'s. You're shown how to execute almost all the options; quizzes and drawing tests at the end of each lesson help to reinforce your understanding. The massive reference manual is somewhat less satisfactory, though. For the most part, it merely lists the steps necessary for each command rather than explaining what the functions do, what you'd use them for, and giving examples.

*MicroCadam* lacks some additional features that are offered by other microcomputer CAD programs. You cannot previsualize an entity as it is defined. There's no dynamic drag as objects are edited. No free-form sketching is possible. These three features are perhaps less significant in mechanical drawing, but they are very helpful in many design situations. Also you cannot hatch objects or create or fill solid objects. The current version of *MicroCadam* cannot create wide objects of any kind—a serious weakness. Many of these features (and support for many more hardware options) are promised for future releases, but, of course, we can review only the program that is on the market right now.

**MIXED REVIEWS** In the final analysis, *MicroCadam* gets mixed reviews. Its biggest problem is the interface. The function-key box is really just an expensive mechanical replacement for a main menu. *MicroCadam* is quite keyboard-oriented, and although its orientation isn't all that inappropriate for a mechanically oriented CAD program, I prefer digitizing tablets and template overlays, which can improve productivity by 30 to 40 percent. A more creative use of color in the prompt areas and fewer abbreviations would improve the screen display. Even better, pull-down menus or other modern interface techniques could make the program much easier to use.

The problem of the interface is counterbalanced, however, by absolutely wonderful construction tools, especially for drawing objects in relation to other elements. These tools are both easy to use and extremely powerful, and you'll feel comfortable using them almost immediately. *MicroCadam*'s techniques make some microcomputer-based CAD programs seem clumsy by comparison.

*MicroCadam* is maddening. In some respects it's more advanced, powerful, and convenient than any microcomputer-based CAD program I've ever used, and, at the same time, it lacks important features and is hampered by a less-than-optimal user interface. *MicroCadam* costs three or four times more than even the most costly competitive microcomputer CAD programs, and it's very clearly not three or four times more program. Those who need *MicroCadam* for compatibility with the mainframe program *CADAM*, however, will be pleased with it. I'm not sure how many others will think it's worth $8,000, but the price seemed a lot less silly to me after I used *MicroCadam*. PC

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*Glenn Hart is a contributing editor of* PC Magazine.

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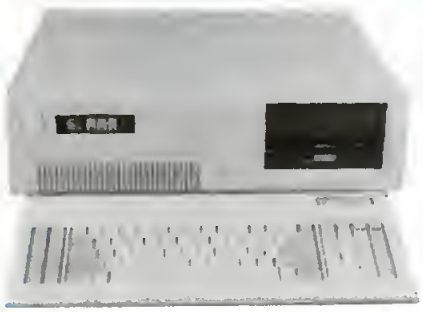

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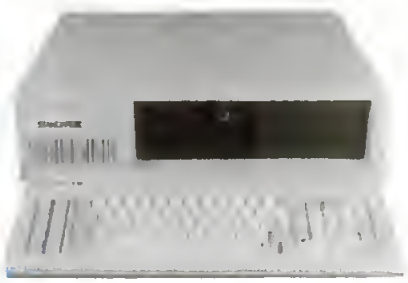

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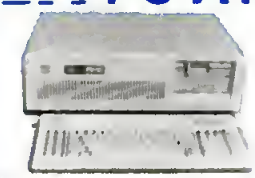

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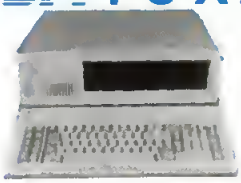

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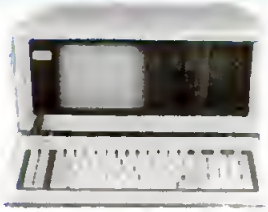

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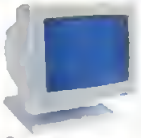

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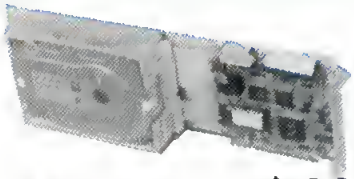

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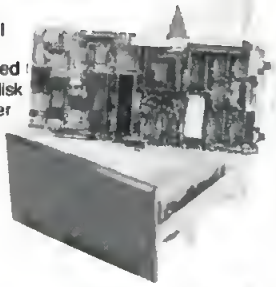

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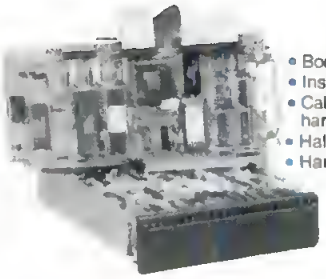

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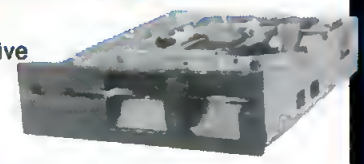

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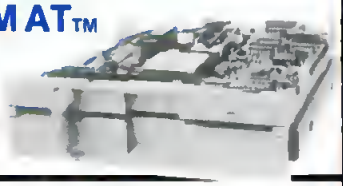

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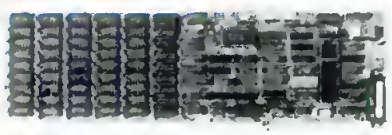

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CIRCLE 104 ON READER SERVICE CARD

# DRAWING A BEAD ON BERNOULLI

*Amcodyne, IDEAssociates, and Sysgen take aim at the market originally pioneered by the Bernoulli Box. These three cartridge-based hard disk systems do double duty as mass-storage devices and backup systems.*

Cartridge-based hard disk systems designed for personal computers never really caught on until Iomega Corp. introduced the Bernoulli Box in 1983 (see "The Bernoulli Solution," *PC Magazine*, Volume 3 Number 18). The Box lent credibility to removable cartridge hard disks. In fact, its almost unbeatable combination of data security, top performance, and almost omnipresent publicity has made removable cartridge disks the preferred modular mass storage system of certain computing cognoscenti.

The Bernoulli Box and other removable media systems share certain strengths: virtually unlimited capacity, excellent backup potential, and one of the most secure methods for data storage. Three new removable cartridge hard disk systems—the PhD from the Amcodyne Division of Century Data Systems, IDEAssociates' Diskit 2 Plus, and Sysgen's DuraPak—are good examples. Each provides the same basic benefits and adds some extras. The PhD offers oodles of hard disk space and very fast data access speeds. The Diskit 2 Plus provides an additional measure of data security. The DuraPak squeezes extra capacity and performance from a very low-cost system.

**REMOVABLE ADVANTAGES** This trio of conventional-technology cartridge hard disk systems promises all the same benefits that removable media give the Bernoulli Box. Storage capacity is virtually unlimited, because you can slide in another disk whenever you need to. You don't have to buy a new drive when you need more disk space.

When you need a reliable backup, a cartridge in the hand is worth at least two in the machine. If you are afraid of losing important files, you need only copy the essentials to duplicate disks—as many as you need to feel secure. When it's time to restore your backups, you won't have to spend days finding the one file you want. Cartridge disks are random access devices, and they work the way you do, delivering what you want when you want it.

When you suspect everyone around you of industrial espionage or incredible curiosity (and you're not even too sure about yourself), cartridges make it easy to keep your valued data under lock and key. Just lock the cartridge in your vault or handcuff it to your wrist.

When you have to transport large programs or multiple megabytes of data across thousands of miles, removable

disks are a nearly perfect data interchange medium. You can carry data cartridges with you in a briefcase or mail them across the continent.

**CHALLENGING THE BOX** The Bernoulli Box has developed a loyal and vociferous following and with good reason: it is a very good storage system. In anyone's book, the Bernoulli Box is the system to beat. One advantage of the Box is its speed. Iomega's nonstandard disk interface uses an 8-MHz data transfer rate that's 60 percent faster than the standard IBM Corp. hard disk interface—in a computer system that can handle data that fast. To compete, Century Data Systems has opted in its PhD system for the faster-still SCSI (small computer system interface) standard and a high-speed head actuator. Sysgen's DuraPak works performance-boosting magic with a conventional interface and mechanism.

Reliability is another of the Bernoulli Box's greatest assets. The Box is unique in using floppy disks that bend around the read/write head, instead of a head that flies about a hard disk. This clever scheme eliminates the possibility of head crashes: you can pick up a working Bernoulli drive, fling it as far as its cord will stretch, and probably not lose a byte on the disk. (The damage to your floor and furniture is another matter. The Box is heavy!)

To battle the Box on the reliability front, the PhD, Diskit 2 Plus, and DuraPak systems use two approaches. Amcodyne has developed a unique (and patented) mechanism for the PhD that the company claims is resistant to head crashes. In addition, Century Data Systems addresses the sturdiness issue directly: the PhD is a hefty machine. IDEAssociates' Diskit 2 Plus and Sysgen's DuraPak use precision, miniaturized components and a tough storage medium that is inherently resistant to crash damage.

The Syquest 3.9-inch (100-millimeter) removable cartridge hard disk system, on which both the IDEAssociates system and the Sysgen system are based, has been around as long as the IBM PC: 5 years. When compared to the Syquest system, even the Bernoulli Box is a newcomer. During these 5 years of development, capacity has tripled (from 5 to 15 megabytes per cartridge in the DuraPak), and bugs have been swatted. At one time the capability of Syquest cartridges to be interchanged among different machines was regarded as being doubtful; today it can be taken for granted.

*Century Data Systems' PhD uses a low-mass Whitney head, which helps it achieve an average access time of about 25 milliseconds and reduces the risk of data damage from disk crashes.*

Although the Diskit 2 Plus and the DuraPak use physically identical cartridges, data cannot be interchanged between the two systems on disk because each uses a different format and recording method.

All three systems are ultimately more reliable than the the Box because Bernoulli disks suffer a shortcoming that ordinary hard disks don't: they wear out. The factory warns that disk life may be as short as a few hundred hours, although most cartridges apparently last much longer.

## PhD

The PhD (for perfect hard disk), from Century Data Systems, combines 60 megabytes of near-conventional nonremovable hard disk storage (on three platters) with a removable 20-megabyte cartridge system for backup and information transfer. The PhD seems to be aimed at the same market as the Bernoulli Box, and it boasts the kind of sturdiness that can be achieved only with truly heavyweight construction. And I do mean heavy: the PhD's large external chassis weighs over 36 pounds.

Like the three nonremovable platters inside the PhD system, the removable disk is 8 inches in diameter, and its shell is just over 8 inches square and nearly 1 inch thick. Thicker and shorter than a Bernoulli cartridge, the PhD cartridge will fit easily in any briefcase.

The PhD is among the easiest systems to install. After you slide its short system interface card into a vacant expansion slot in your PC and string a single cable between the PhD and its host, you need run only a single set-up program. This program automatically partitions and formats

PC MAGAZINE FACT FILE

**PhD**
Century Data Systems
Amcodyne Division
1301 S. Sunset St.
Longmont, CO 80501
(800) 262-6743
(303) 772-2601
**List Price:** $6,995; cartridges $175.
**Requires:** 128K RAM, DOS 3.1 or later.
**In Short:** A very sturdy 60-megabyte hard disk with built-in 20-megabyte removable cartridge backup; a novel, crash-proof design, and high-speed data access.

CIRCLE 634 ON READER SERVICE CARD

Photographs: Thom O'Connor

the PhD system. The 60 megabytes of fixed disk space are automatically split into three 20-megabyte partitions, one of which can boot your computer; and the cartridge acts as a fourth.

Century Data Systems provides no easy way of reconfiguring the system to suit more specialized needs. For instance, you might prefer two 30-megabyte partitions to three of 20 megabytes. In addition, the PhD's host interface card is equipped solely with an 8-bit data bus, which will effectively limit it to half-speed with 16-bit systems like the PC AT.

Several features of the PhD system break with past traditions and technologies of removable cartridge hard disks. The PhD uses a low-mass Whitney head instead of one of heavier, older Winchester design. The smaller head helps it achieve a very fast average access time, about 25 milliseconds. It also helps reduce the possibility of data damage caused by disk crashes.

To enhance performance, the PhD uses one-to-one sector interleaving instead of the six-to-one interleaving used in PC/XT drives or the three-to-one interleaving that's standard in ATs. A full track of data is buffered by the PhD controller to cut access time still further.

**QUICK ACCESS TIME** The PhD's cartridge and nonremovable hard disks use the same spindle (drive shaft), motor, and drive electronics. Further, both drive systems can use one high-speed head actuator, so all drives have the same very quick 25-millisecond average access time.

Although the unit's SCSI interface promises faster data transfer, its design is not the most favorable when used with typical PC applications. While it does speed transfers of large blocks of information, it adds a good deal of operating overhead for each block. When you require smaller chunks of data, as is typical in PC systems that use small 512-byte disk sectors and allocation units from 512 to 8,096 bytes (depending on operating system and medium), the processing overhead reduces the advantage of the faster transfer speed.

The unique single-spindle design also imposes some drawbacks. For instance, it defeats part of the purpose of a backup system. If the fixed hard disk fails because of a drive problem, the backup system fails for exactly the same reason.

Changing cartridges can be time consuming. Not only must the cartridge platter cease its spin before you can remove it, but because all platters share the same spindle, all must stop when a cartridge is changed. The spin-down and spin-up involved in changing cartridges require about 1½ minutes—independent of the time to extract the old and insert a new cartridge—and the whole mass storage system is down for the same interval. In effect, you'll have to shut down your computer just to switch cartridges.

## Diskit 2 Plus

One of the biggest advantages of a cartridge hard disk—the security of locking your database away—can also be a disadvantage. A light-fingered ne'er-do-well can easily lift your entire accounts receivable, customer list, or (shudder) video game collection by sliding a single cartridge into his trench coat.

IDEAssociates guards against such disasters in its Diskit 2 Plus removable cartridge system. With a single software command, you can encode the contents of each disk cartridge using the super-safe DES (data encryption standard) algorithm. A thief can make off with your cartridge but won't be able to do anything with its contents.

Even without encryption, however, the Diskit 2 Plus is a system worth considering. It's one of the most cleverly designed, compact, and convenient external disk subsystems available.

The system capitalizes on the compact design of the Syquest removable cartridge Winchester system by packing two of the tiny drives side by side in a case that fits neatly under a monitor: it's about 14 inches

PC MAGAZINE FACT FILE

**Diskit 2 Plus**
IDEAssociates Inc.
29 Dunham Rd.
Billerica, MA 01821
(617) 663-6878
**List Price:** $3,595; cartridges, $99.
**Requires:** DOS 2.0 or later (3.1 or later recommended).
**In Short:** A compact two-drive removable cartridge hard disk system based on the Syquest 100-millimeter 10-megabyte cartridge with the added advantage of internal data encryption using the DES standard.

CIRCLE 633 ON READER SERVICE CARD

*The data encryption standard algorithm in IDEAssociates' Diskit 2 Plus prevents thieves from reading a cartridge's contents. Other pluses are its compactness and easy installation program.*

## Benchmark Tests: Removable Hard Disks

The IBM Seagate ST-412 and Bernoulli Box results are shown for comparison. Both the Bernoulli Box and PhD bypass DOS's BIOS: they are accessed through their own CONFIG.SYS-based driver files. As the results indicate, bypassing DOS allows for faster access times (in the case of the PhD, faster for most operations than even the IBM hard disk). The only drawback to using driver files in place of DOS's BIOS is that key-disk-based copy-protection schemes may not be able to address the drive.

The **File Access** benchmark test measures the time it takes to create and sequentially write a 256K-byte data file using a record length of 512 bytes. The test program then performs a series of operations: a sequential overwrite, a sequential read of the same file, and a random overwrite and a random read.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3, and the interleave factor is left at the driver's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times using the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

### Performance Times

(Times given in seconds and decimal seconds, except where noted.)

| | File Access | | | | | DOS Disk Access (milliseconds) | BIOS Disk Seek (milliseconds) |
|---|---|---|---|---|---|---|---|
| Product* | Creats | Sequential writs | Sequential resd | Random write | Random resd | | |
| Diskit 2 Plus (10 MB) | 26.55 | 52.15 | 25.61 | 104.80 | 72.05 | 190.65 | 138.25 |
| DuraPak (15 MB) | 24.30 | 29.56 | 14.76 | 48.67 | 41.10 | 145.28 | 83.99 |
| PhD (20 MB) | 13.98 | 17.50 | 9.06 | 22.99 | 16.61 | 39.90 | † |
| Bernoulli Box (10 MB) | 21.97 | 42.33 | 21.86 | 40.79 | 24.66 | 64.59 | † |
| IBM Seagate ST-412 (10 MB) | 11.81 | 11.90 | 11.68 | 30.16 | 22.96 | 114.19 | 95.27 |

*Size of DOS disk partition is indicated in parentheses. †Does not support BIOS calls.

wide, 13 inches deep, and 2¼ inches high. The metal case is sturdy enough to support the most robust of monitors, and its stylishly molded top plate will allow sufficient airflow to keep your display cool.

Despite its small size, the Diskit 2 Plus is noisy, noticeably louder than the PC system unit to which it attaches. The cooling fan is the culprit; the disk drives themselves seem to operate almost silently.

Diskit 2 Plus connects to its host PC or PC-XT via a single full-length expansion card designed by IDEAssociates. A 1-meter cable with a male 62-pin connector at each end ties the card to the disk chassis. The controller uses the standard ST506 host interface and MFM (modified frequency modulation) recording to pack 10 megabytes into each cartridge.

**EASY INSTALLATION** Setting up the system is fast and easy using the latest IDEAssociates software. (The hardware itself has only one external control, an on/off button.) Although earlier IDEAssociates installation programs were notably Byzantine, the current incarnation is straightforward enough for even relatively new users to operate.

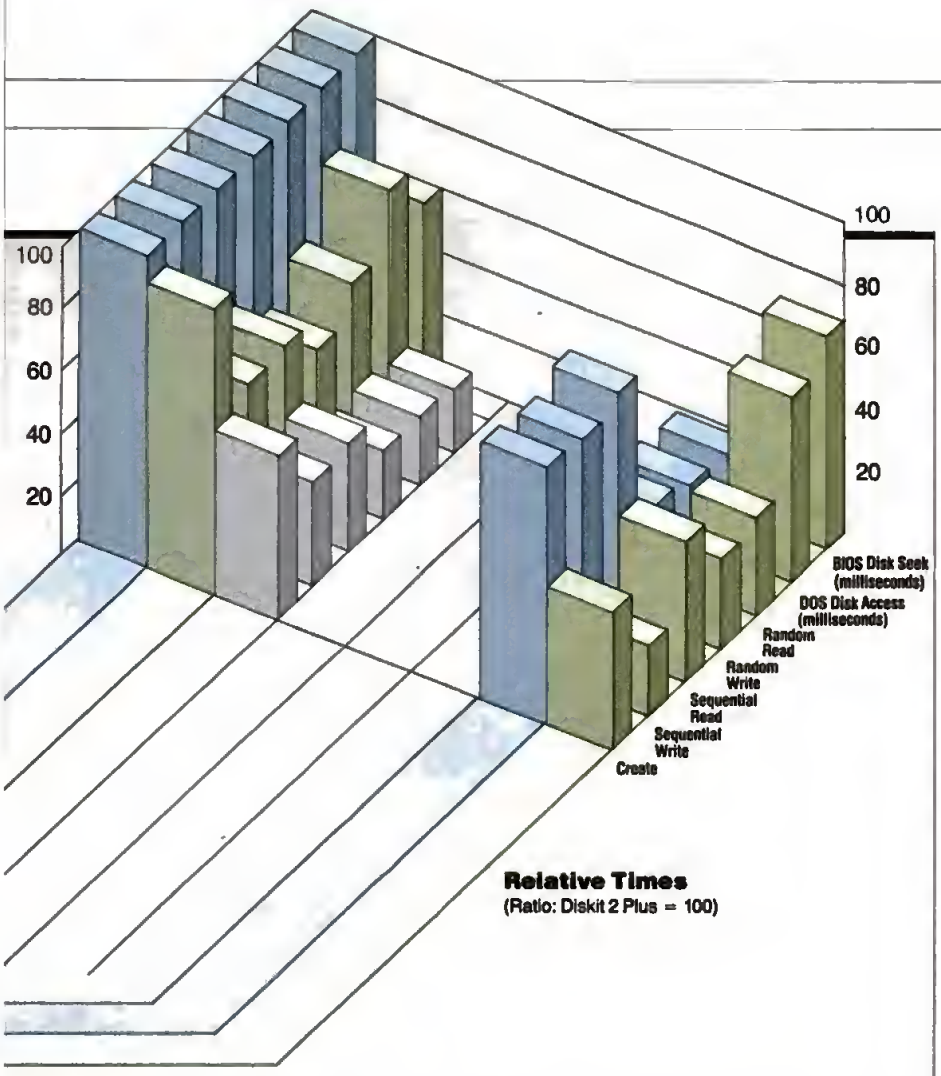
The software actually duplicates the function of most of the IBM disk set-up programs, including FDISK and FORMAT. You'll need a DOS disk only for the latter and to transfer the operating system to the disk cartridge. A low-level formatting program is provided so that you can start with genuinely blank disk cartridges.

■ The encryption scheme imposes some overhead on disk operation, but not enough to be noticeable except in time-critical applications.

The first step in installation is to diagnose the system and verify that all connections are properly made and switches and jumpers properly set. This complete diagnostic procedure takes less than 1 minute and displays plain English messages. Afterward, you can prepare a disk cartridge for operation in under 10 minutes (about 5 minutes for the hard format and 3½ minutes for a DOS format). You'll need to perform these operations only once in the life of a disk.

The two drives operate independently although not simultaneously; only one drive can be accessed at a time, even when files are copied from one to another.

IDEAssociates obviously believes that the Diskit 2 Plus makes a good backup system, because it provides software that automatically duplicates one cartridge on another—essentially DISKCOPY for the megabytes. However, the program does




not save much time when compared to using the DOS command COPY *.*. It requires 3 minutes, 20 seconds for an image copy versus 3 minutes, 45 seconds for the DOS command and a full disk. When the disk is less than full, DOS will win every time. Although the IDEAssociates Icopy command does copy through subdirectories, other programs that work like the DOS COPY command might be more efficient.

**A FIRM ENCRYPTION SCHEME** The encryption scheme used by the Diskit 2 Plus is based in firmware that's part of the controller card's ROM. Before the host system loads DOS from any disk drive, the ROM requests you to select which drives, if any, you want to use in encrypted form. If you want either or both encrypted, the system prompts you to enter a password (a separate password for each drive if you choose both). You must type the same password twice to verify and to guard against typing errors.

The password is used to determine how all data is recorded on disk, including partitioning information. If you later give a password that does not match the one used when the disk was initially partitioned and formatted, the host system will not recognize it as a valid drive. You cannot even use a DOS tool kit or byte editor to see what's there. Even experienced users should be thwarted from probing into your data by the IDEAssociates encryption scheme.

The encryption scheme imposes some overhead on disk operation, but not enough to be noticeable except in time-critical applications. It added about 12 percent to the time needed to create a large file. Reading the file required the same amount of time, whether encrypted or not.

The system will not boot from an encrypted drive, but encrypting a disk containing the operating system is not a good idea because the operating system puts well-known material at standard locations on the disk. Knowing exactly what's at a given location on the disk makes the job much easier when a cipher expert wants to break into your disk's code.

## DuraPak

Like the Diskit 2 Plus, Sysgen's DuraPak takes advantage of the small size of the Syquest cartridge drives. Sysgen, too, makes a double-cartridge-drive package that's just about the width of an IBM Monochrome Display (12 inches) and fits comfortably between a PC and its monitor.

The DuraPak system uses a single full-length expansion card, that is actually a modified Adaptec 2070A RLL hard disk controller, to interface with the host computer. Sysgen adds cabling and a connector to the card, as well as a plastic guard over the foil side of the board. The controller connects with the DuraPak chassis through a 4-foot cable with male DB-37 connectors at each end.

Sysgen supplies cartridges that have already been low-level formatted (also partitioned and DOS formatted, albeit without system files). Although Sysgen provides programs for formatting, it gives you no physical (low-level) formatting program. You must buy preformatted cartridges from the company.

The DuraPak's drives seem to be the same as those in the Diskit 2 Plus, but Sysgen is able to squeeze extra performance and capacity from them. The capacity boost comes from the controller's RLL coding, which enables Sysgen to pack 15 megabytes on a standard Syquest 10-megabyte cartridge. RLL uses a special

PC MAGAZINE FACT FILE

**DuraPak**
Sysgen Inc.
47853 Warm Springs Blvd.
Fremont, CA 94539
(415) 490-6770
**List Price:** $2,295; cartridges, $115.
**Requires:** 64K RAM, DOS 2.0 or later.
**In Short:** A compact two-drive removable cartridge hard disk system based on Syquest's 100-millimeter cartridge with enhanced performance and capacity (15 megabytes per cartridge).

CIRCLE 632 ON READER SERVICE CARD

# TWO THREATS TO YOUR DATA'S LIFE

*To keep your backed-up data safe, be on the alert for airborne pollutants, like cigarette smoke, and learn how to handle cartridges.*

The biggest disadvantage of removable media is their sensitivity to dirt. Winchester heads fly about a dozen microinches (millionths of an inch) above the hard disk surface on a cushion of air. Dust and airborne pollutants are huge compared to that tiny disk-to-head gap. Even particles of cigarette smoke are larger. When any of these atmospheric contaminants settles on the disk surface, the low-flying head can bash into it and upset its smooth flight.

The likely result is the miniaturized equivalent of a tailspin: the head crashes down on the disk surface. With some kinds of hard disks, the outcome can be disaster. The typical Winchester read/write head is much harder than an oxide-coated disk. If the head touches the disk surface while the disk is rapidly spinning, it can plough a furrow in the soft disk coating, digging up your data along with it.

**FILTERING OUT POLLUTANTS** Nonremovable PC-size hard disks are manufactured in clean rooms and are hermetically sealed against airborne contamination. In most removable-media drives, the principal preventive measure used to ensure against hard disk head crashes caused by dirt is filtering. A stream of highly filtered air is constantly forced through the cartridge, thereby preventing outside air and its pollutants from entering the cartridge.

The air stream is interrupted, of course, whenever you switch the disk drive off or remove the cartridge. To prevent "evil airs" from entering the system at those times, most cartridge makers do their best to seal out the normal atmosphere. All use a door that, when the cartridge is taken out of its drive unit, slides over the opening through which the head enters the cartridge and seals the cartridge.

Coated disks are also in danger when you switch off the drive mechanism. As the rotation of the disk slows—when the disk "spins down"—the air cushion that the head floats on deteriorates, until the head finally settles down and actually comes to rest on the disk surface. If the head comes down too rapidly when the disk is still spinning, the soft disk coating can be damaged. Similarly, when the disk begins spinning with the head resting on its surface, the head can gouge the delicate disk surface before it has a chance to take off.

■ In most removable-media drives the principal preventive measure used to ensure against head crashes caused by dirt is filtering.

Century Data Systems' PhD has managed to eliminate the possibility of these head crashes by loading the head—allowing it to approach the active disk surface—only after the disk is up to speed and retracting the head before the disk spins down.

The preventive measure used in IDEAssociates' Diskit 2 Plus and Sysgen's DuraPak is a tougher recording medium on the disk surface. Plated hard disk surfaces are actually harder and more scratch resistant than read-write heads are. The hard magnetic medium effectively protects itself from head crashes caused by contaminants and the drive's spinning up or down.

**INS AND OUTS** Loading and unloading cartridges can also prove to be dangerous to data stored on the disks. Before you can remove a cartridge from a drive, the head must be withdrawn from within the cartridge safely, with no chance for disk contact, and the disk must stop spinning.

The disk cartridge shell is merely a protective covering for the disk platter. When the cartridge is in use, its support and bearings are supplied by the drive unit. Without that support, the platter (or its hub) rubs against the shell and may scrape particles of plastic off the shell. Like any airborne contamination, these particles can cause head crashes. Worse, they may be trapped inside the cartridge, where they can cause damage much later—when you're least suspecting it.

The PhD guards against these problems with an elaborate scheme that locks the cartridge in place until the disk stops spinning entirely. Only then can you remove it from the drive.

The Syquest drives that are used by both the Diskit 2 Plus and the DuraPak also lock their cartridges against removal while their internal disks are spinning down (unlike earlier Syquest drives, which merely warned against, rather than prevented, the removal of still-spinning cartridges). On current Syquest drives, pressing the square white button initiates the spin-down process. The disk activity light flashes red during spin-down and then goes out entirely. At that point you can press the same button again to open the drive door and safely remove the cartridge.

The Syquest scheme is not perfect, however. You can switch off system power and immediately pop out a cartridge with a still-spinning disk. The scraping sound you'll hear will convince you never to try that again.

**—Winn L. Rosch**

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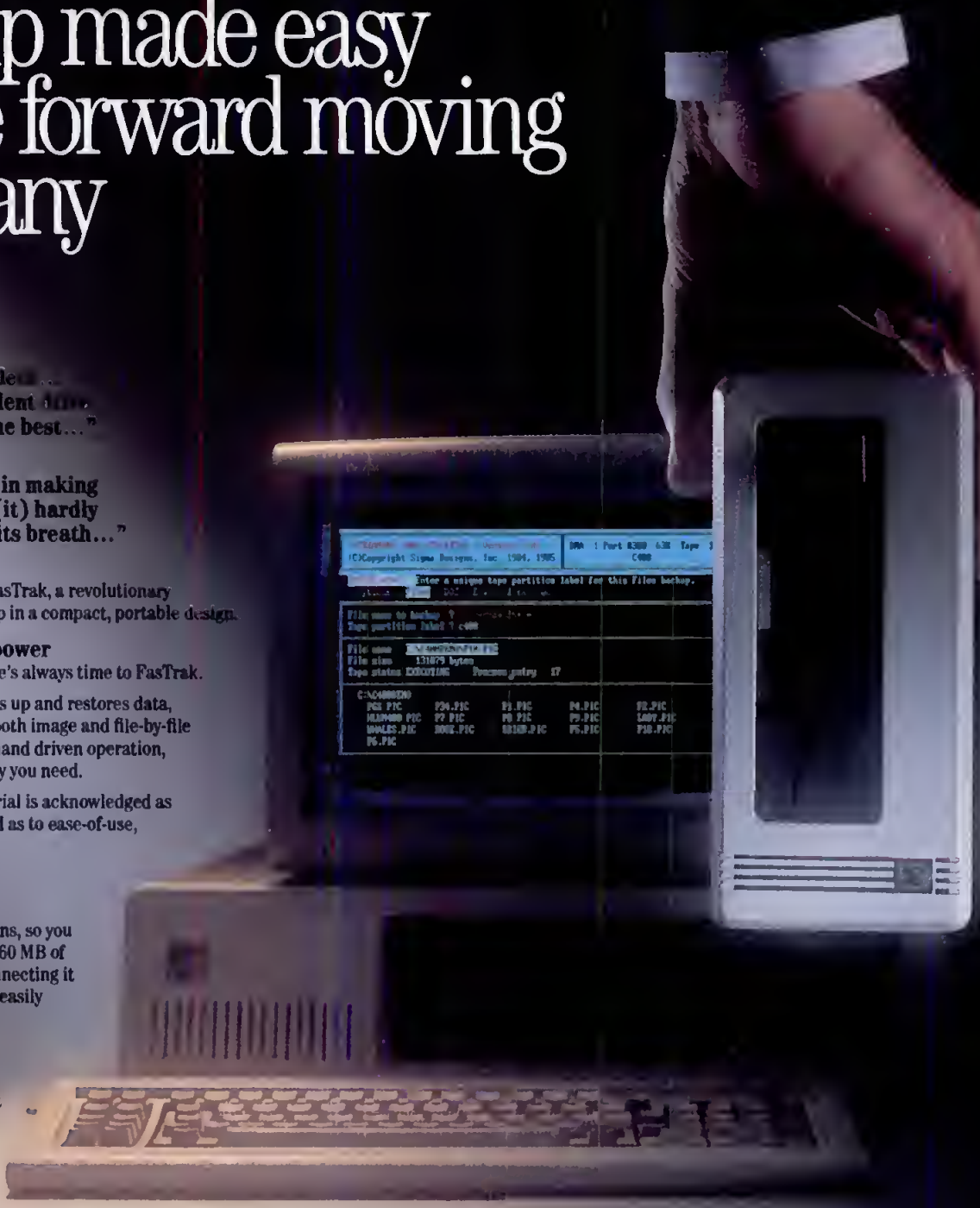

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PC Tech Journal

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PC Magazine

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27 or 60 MB tape drive

SIGMA DESIGNS

SIGMA DESIGNS, INC. 2023 O'Toole Avenue, San Jose, CA 95131, telex 171240
CIRCLE 252 ON READER SERVICE CARD

*RLL coding in the Sysgen DuraPak's controller packs 15 megabytes on a Syquest 10-megabyte cartridge and speeds up data transfer at a rate of 7.5 MHz when used with the ST506 interface.*

digital code that puts information on-disk more densely without altering the hardware in any way (see "Supercharging XT Hard Disk Performance," *PC Magazine*, Volume 5 Number 21).

RLL also helps speed performance because it transfers data at a rate of 7.5 MHz when used in conjunction with the ST506 interface that the Syquest drives employ. MFM, the traditional recording scheme, has a data rate of 5 when used with that interface.

Sysgen has also pulled off a coup of sorts by getting a better-than-XT average access time from the admittedly slow Syquest drives. In IDEAssociates' configuration the drives turn in access times of about 135 milliseconds; Sysgen reduces the times to under 85 milliseconds. The speed-up was achieved by close cooperation between Syquest and Sysgen (which just happen to be located across the street from one another).

Normally, the Syquest drive requires three spins to locate a track unambiguously. That measure of security is mandatory when writing to the disk but is only a luxury when the drive is merely reading the disk. For disk reads, Sysgen requires only one spin to identify a track but sticks with three before writing. The result is quicker access times with no compromise in data integrity.

**PINPOINTS DEFECTS** Sysgen supplies several support programs with the DuraPak system. A device driver allows you to use more DuraPak drives than the two directly supported by the IBM BIOS. A diagnostic program helps you find problems in the disk system; it excels at finding mistakes made when you initially set up the system (and at pinpointing defective equipment).

The DuraPak disks do not use the normal DOS partitioning (FDISK) and formatting utilities, so Sysgen supplies its own versions. The system also includes a utility for duplicating disks quickly, useful in making backups.

■ DuraPak's diagnostic program helps you find problems in the disk system; it excels at finding mistakes made when you initially set up the system.

Sysgen also gives you a program designed to notify your computer system that you are changing cartridges in a Sysgen drive. You must run the program DPPAK before changing cartridges or, as both the manual and an ominous on-screen message warn, " Data may be lost." The on-screen warning amazes me: I can't help wondering if the system knows enough to put a message on the screen warning you to run DPPAK, shouldn't it be smart enough to do whatever DPPAK does all by itself?

The DuraPak system is a well-made, high-performance addition to an 8088-based PC system. Although it will function with ATs as well, like the other two 8-bit systems investigated here, it can't be expected to deliver the performance of the IBM PC AT hard disk. In such applications, 8-bit removable cartridges are best used primarily for backup and secondary storage operations.

Each of these drives challenges the industry leader, the Bernoulli Box, in its own way. And each system has its own advantages that may make it a perfect choice for your system and application.

*Winn L. Rosch is a contributing editor of* PC Magazine.

## PC MAGAZINE EDITOR'S CHOICE

***One of these removable cartridge hard disk units is likely to please you. Your needs will determine which one. If you're a speed junkie, go for Century Data Systems' PhD with its SCSI interface. But if nightmares about spying eyes on your classified data haunt your sleep, you should buy IDEAssociates' Diskit 2 Plus. Its encryption scheme is a great feature for those who need security. And if price is the factor that will make up your mind, Sysgen's DuraPak will give you the most storage for your money. It can't compete with the PhD on speed, but it's the least expensive way to try out the technology.***

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*InfoWorld Mar 86*

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*Business Computer Digest*
*Aug 86*

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*Jerry Pournelle,*
*Byte Magazine Sept. 86*

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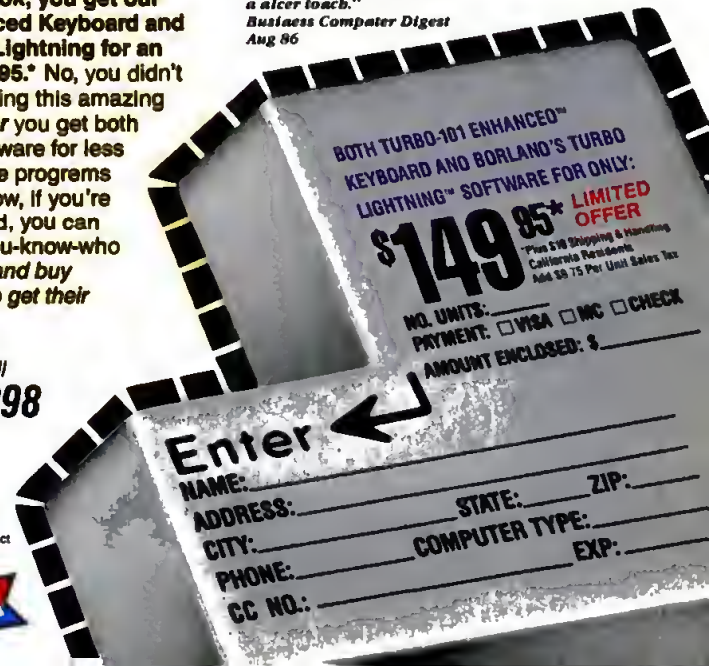
*Test Drive Scorecard:*
*DataDesk 10 Key Tronics-9 Telecoanect Magazine*
*May 86*

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CONNECTIVITY:
Third in a Continuing Series

# MAKING CONNECTIONS

# The IBM Token-Ring Network

Together the IBM Token-Ring Network hardware and IBM's *PC Local Area Network Program* software are a flexible, fast, industrial-strength team. But the lack of any built-in troubleshooting and diagnostic reporting tools prevents the IBM system from being the top LAN on the market.

FRANK J. DERFLER, JR.

The IBM Token-Ring Network is to networks what the Boeing 747 is to airplanes. It makes strange noises and requires special handling but can carry heavy loads. It offers power and flexibility but demands skilled management and control. It is one of the fastest things flying but not one of the prettiest. In fact, its design seems to shout, "Engineering!" To its advantage, it's an industrial-strength network.

We evaluated the IBM Token-Ring Network system using IBM networking hardware and IBM's *PC Local Area Network Program* networking software. For comparison, we ran Novell's *Advanced NetWare/286*, Version 2.0a, on the same server and network hardware as a benchmark test. The results of the speed tests show a slight edge for the Novell system but excellent overall performance for both combinations of hardware and software.

**TOKEN HISTORY** IBM Corp. didn't invent the concept of tokens or the idea of a ring configuration. Indeed, IBM paid a fee, said to be in the area of $5 million, to clear a patent on token-ring networking filed by Olof Soderblom of the Netherlands. Other companies in the token-ring business have to decide to either fight or accommodate the IBM claim.

The Institute of Electrical and Electronic Engineers (IEEE) 802.5 standard defined the characteristics and operation of a token-passing LAN with a ring topology. IBM representatives took a firm lead in the IEEE committee that established the 802.5 standard. IBM also put identical LAN standards into place

within the structure of the European Computer Manufacturers Association. (For more about the standard and other background information on the IBM Token-Ring-Network, see "The IBM Token-Ring LAN: What? Why? Now?" *PC Magazine*, Volume 5 Number 5.)

Establishing the multiple standard apparently nurtured the faith of the semiconductor companies. Texas Instruments is leading a pack of companies who are selling relatively inexpensive chip sets like the TMS 380 that can perform all the functions of the 802.5 standard. Companies such as 3Com Corp. and Ungermann-Bass are using these chips to market network adapter cards following the 802.5 standard.

*The IBM #8228 Setup Aid is a hand-held device that you plug into each port of the Multistation Access Unit. It aligns the relay contacts in the Multistation Access Unit before you install the workstations.*

**TOKEN TECHNIQUE** The token-ring access technique is based on the use of a single token that circulates among the stations when they are all idle. A station with a message to transmit waits until it receives a token. It then changes the token from a *free token* to a *busy token*. The station transmits a block of data, called a *frame*, immediately following the busy token. The frame contains all or part of the message the station has to send.

When a station transmits a message, there is no free token on the network, and so other stations wishing to transmit must wait. The receiving station copies the data, and the frame continues on the ring, making a complete round-trip back to the transmitting station. The transmitting station purges the busy token and inserts a new free token on the ring when it has finished transmitting its frame, and the busy token has returned. The use of the token-ring system prevents messages from interfering with one another, by guaranteeing that only one station at a time transmits.

Using tokens to regulate when a station can transmit over a shared wire isn't unique. The ARCnet system, originated by Datapoint Corp. and fostered in the microcomputer world by Standard Microsystems Corp., and ProNET-10, from Proteon, both use tokens to regulate traffic. (For reviews of these systems, see *PC Magazine*, Volume 5 Number 21.)

The ARCnet and ProNET-10 token schemes operate slightly differently from the IBM token-ring scheme because the stations are connected to a common transmission bus rather than a ring. Free tokens are specifically addressed to the stations on the bus according to a unique identification on their network interface cards. Theoreticians argue that the passing arrangement of the ring eliminates some of the overhead of addressing individual tokens, but in practice other factors, such as the size of the memory buffers in the server, affect network speed much more than the network sharing scheme does.

**MULTISTATION ACCESS UNIT** Physically, the IBM Token-Ring doesn't look like a ring with wires running from machine to machine. Instead, it is like a star, with a multiconductor cable going from each machine to a central connection point IBM calls a Multistation Access Unit. Inside the Multistation Access Unit, the wires in the cables are arranged to make an electrical ring, but each workstation and server has only one multiconductor cable, connecting it to the Multistation Access Unit.

The ARCnet and ProNET-10 systems connect their cables to a central wiring hub in a configuration that geometrically looks identical to that of the IBM Token-Ring, but electrically it's very different. The ARCnet and ProNET-10 stations are on a cable bus, and every station hears every message. The IBM Token-Ring is electrically a ring, and a station hears only the messages passed from the station before it in the ring.

Systems like ProNET-10, ARCnet, AT&T Information Systems' StarLAN (for more information about StarLAN, see *PC Magazine*, Volume 5 Numbers 21 and 22), and the IBM Token-Ring use the central cable hub concept because it makes it easier to keep the network intact when you're moving equipment. The central cable hub also simplifies troubleshooting the network because you can find all the connections at a central point.

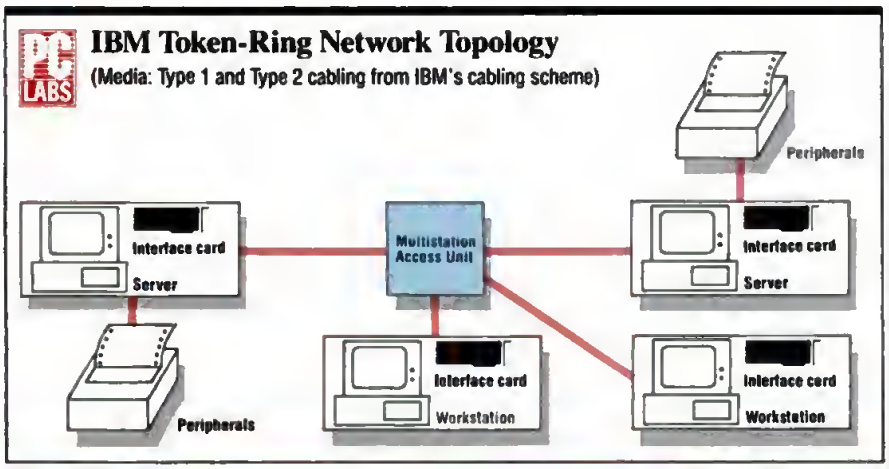
Unfortunately, the IBM Multistation Access Units give you no visible indication that the network is operating. There are no lights to indicate a good electrical connection, as there are on the ProNET-10 hub, or indications of network operation, as there are on the StarLAN and ARCnet hubs. These indicators, although primitive, are still very useful in troubleshooting network cable and connection problems. IBM should have taken a lesson from these other companies in providing some visual clue of proper connection or operation.

You can connect the IBM Multistation Access Units together to form a larger ring. Each Multistation Access Unit has connection points that allow up to eight personal computers or other devices to gain access to the network. The Multistation Access Unit can be placed in a 19-inch rack or in a special cabinet for desk or wall mounting.

**CONNECTING THE RING** The IBM Token-Ring system is available in a starter kit that includes enough network interface cards and cables for four nodes and a Multistation Access Unit able to accommodate eight nodes. The cables are of two types—coaxial and twisted pair—and the connectors are unique to the IBM system. The software in the starter kit includes the IBM *PC Local Area Network Program*, the Network Basic Input/Output System (NETBIOS), and an installation program. The IBM Token-Ring Network Starter Kit is more complete than that offered by the other networks we reviewed.

The network interface cards are full-length circuit boards with a 9-pin DIN connector on the back that is identical to the connector for the color monitor. Given that the odds of something going wrong during any PC installation are an exponential factor tied to the number of boards and workstations, someone is likely sometime to hook the monitor to the network card and

Photographs: Richard Lakin



*The IBM Token-Ring Network system consists of (1) a network adapter card, (2) cabling, (3) the Multistation Access Unit, and (4) the* PC Lan *software. You can use Type 1 or Type 2 media from IBM's proprietary cabling scheme. Type 1 cabling uses a combination of cables that includes coaxial cable. Type 2 consists of twisted-pair wires, and, in specific installations, previously installed telephone wiring. Multistation Access Units can be connected together to serve as many as 260 network nodes.*

*The IBM Token-Ring Network uses a physical star topology, but electrically, the stations on the network are connected in a ring. Any station on the network can contribute resources such as printers or disk drives to the network or operate as a workstation only or a server only. When a station signs on or off the network, the Multistation Access Unit automatically breaks and remakes the electrical connections.*

the network to the video card. It happened to us, so we can tell you that if you see a monitor screen turn bright blue, you should shut off the power and check the cable connections.

Each IBM network interface card contains an 80186 processor and associated RAM and ROM. The cards are ready to install as they come out of the box. You need only reset the switches on the card if you want to put more than one interface in a network node. You might do so if you want a workstation or a server to be on more than one network. IBM has limited your chances of error by gluing down certain switches that should not normally be changed.

Installing the Multistation Access Unit can be fun; you feel a real sense of accomplishment as you get the immediate feedback of the red lights and the clicking noises that indicate that you're actually doing something. Here's how you install the unit.

First, you search the shipping box to find (and make sure you never lose!) a device IBM calls the #8228 Setup Aid. It has a little red light, fits snugly in the hand, and sports businesslike contact electrodes at the end.

PC MAGAZINE FACT FILE

**IBM Token-Ring Network**
IBM Corp.
Old Orchard Rd.
Armonk, NY 10504
(914) 765-1900
**Workstation Requirements:** 256K RAM, DOS 3.2.
**Server Requirements:** 256K RAM, DOS 3.2.
**Networking Software:** *PC Local Area Network Program*, Novell's *Advanced NetWare*, Torus's *Tapestry*, and all other networking software that supports NETBIOS.
**List Prices:** IBM Token-Ring Network Starter Kit, $4,065; *PC Local Area Network Program*, $125; Adapter Cards, $695; Multistation Access Unit (#8228 Setup Aid), $660; cabling prices vary among authorized dealers.
**In Short:** An industrial-strength network system that is fast and flexible but lacks built-in troubleshooting and diagnostic reporting tools.

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CIRCLE 183 ON READER SERVICE CARD

You plug the Setup Aid into each port on the Multistation Access Unit and wait 3 seconds for the light to go out. You must do this ten times to get the whole system operational.

The Multistation Access Unit isn't powered by the wall socket, and so you must initialize each port with the little battery in the Setup Aid. The Setup Aid lines up the contacts on all the relays in the Multistation Access Unit regardless of how they were bounced around in shipping.

Plugging the cables from the workstations into the Multistation Access Unit requires using some force, unlike the delicate action you use to snap in the cables for systems like the StarLAN. You know when the connection is made by the positive "crunch" you feel—a far cry from the "snap click" of the StarLAN, in which you plug in the connectors in a way similar to how you'd plug a modular telephone plug into a wall jack. (Although the "snap click" and the "crunch" methods of connecting the systems are different, they both work equally well.)

**MAKING THE RING** When a station checks into or out of the Token-Ring Network, several adjustments are automatically made to the network. Since the network is a ring both electrically and logically, the software and the hardware must be adjusted every time a station signs on or off the system. The Multistation Access Unit must rearrange the connection of the wires in the cables to insert or remove a station. If you understand what is happening and you sit close to the Multistation Access Unit, you can hear the contacts clicking as the sign-on program progresses on the screen of the station coming into the network. If a station loses power or network connection, the system readjusts without any noticeable delay in operation, but with a little click-click sound from the Multistation Access Unit.

**IBM PC LAN SOFTWARE** The software IBM markets in North America for the Token-Ring system is the *PC Local Area Network Program*. Outside North America, IBM also markets *Tapestry* software with the Token-Ring hardware because the *Tapestry* icon-based command structure needs no translation.

## Benchmark Tests: IBM Token-Ring Network

The critical factor for these benchmark tests is the speed degradation that the network demonstrated under load. None of the systems tested here degraded significantly under heavy load. However, the IBM Token-Ring Network hardware ran slightly more slowly under *PC Local Area Network Program* than under *Advanced NetWare/286A*. In addition, the fact that IBM Token-Ring Network hardware running both *PC Local Area Network Program* and *Advanced NetWare/286A* ran more slowly than Standard Microsystems' ARCnet or Novell's NetWare/S-Net indicates that IBM's token-passing ring scheme imposes network overhead not found in ARCnet's token-passing bus or NetWare/S-Net's dedicated connection scheme.

### Network Speed Under Contention Test

**Performance Times**
(Times given in seconds and decimal seconds)

| Interface cards | Software | Server | Zero stations | One station | Two stations | Three stations | Four stations |
|---|---|---|---|---|---|---|---|
| IBM Token-Ring | *PC Local Area Network* | 8-MHz IBM PC AT | 63 68 | 71 54 | 83 47 | 97.41 | 110 73 |
| IBM Token-Ring | *Advanced NetWare/286A* | 8-MHz IBM PC AT | 55 83 | 60 16 | 64 10 | 73.29 | 79 52 |
| NetWare/S-Net | *Advanced NetWare 68* | Novell Server 68B | 71.00 | 83 70 | 94 29 | 103.71 | 115 68 |
| ARCnet | *Advanced NetWare/286* | 8-MHz IBM PC AT | 59.45 | 62.14 | 67.83 | 78.21 | 92.56 |

### Network plus Server Cruncher Test

**Performance Times**
(Times given in seconds and decimal seconds)

| Interface cards | Software | Server | Zero stations | One station | Two stations | Three stations | Four stations |
|---|---|---|---|---|---|---|---|
| IBM Token-Ring | *PC Local Area Network* | 8-MHz IBM PC AT | 63 68 | 88 00 | 130 05 | 171 48 | 216 11 |
| IBM Token-Ring | *Advanced NetWare/286A* | 8-MHz IBM PC AT | 55 83 | 95 68 | 131.16 | 147 97 | 177.52 |
| NetWare/S-Net | *Advanced NetWare 68* | Novell Server 68B | 71 00 | 73 05 | 79 45 | 86 87 | 91 00 |
| ARCnet | *Advanced NetWare/286* | 8-MHz IBM PC AT | 59.45 | 85.85 | 79.87 | 110.65 | 128.63 |

### Smart Applications Test

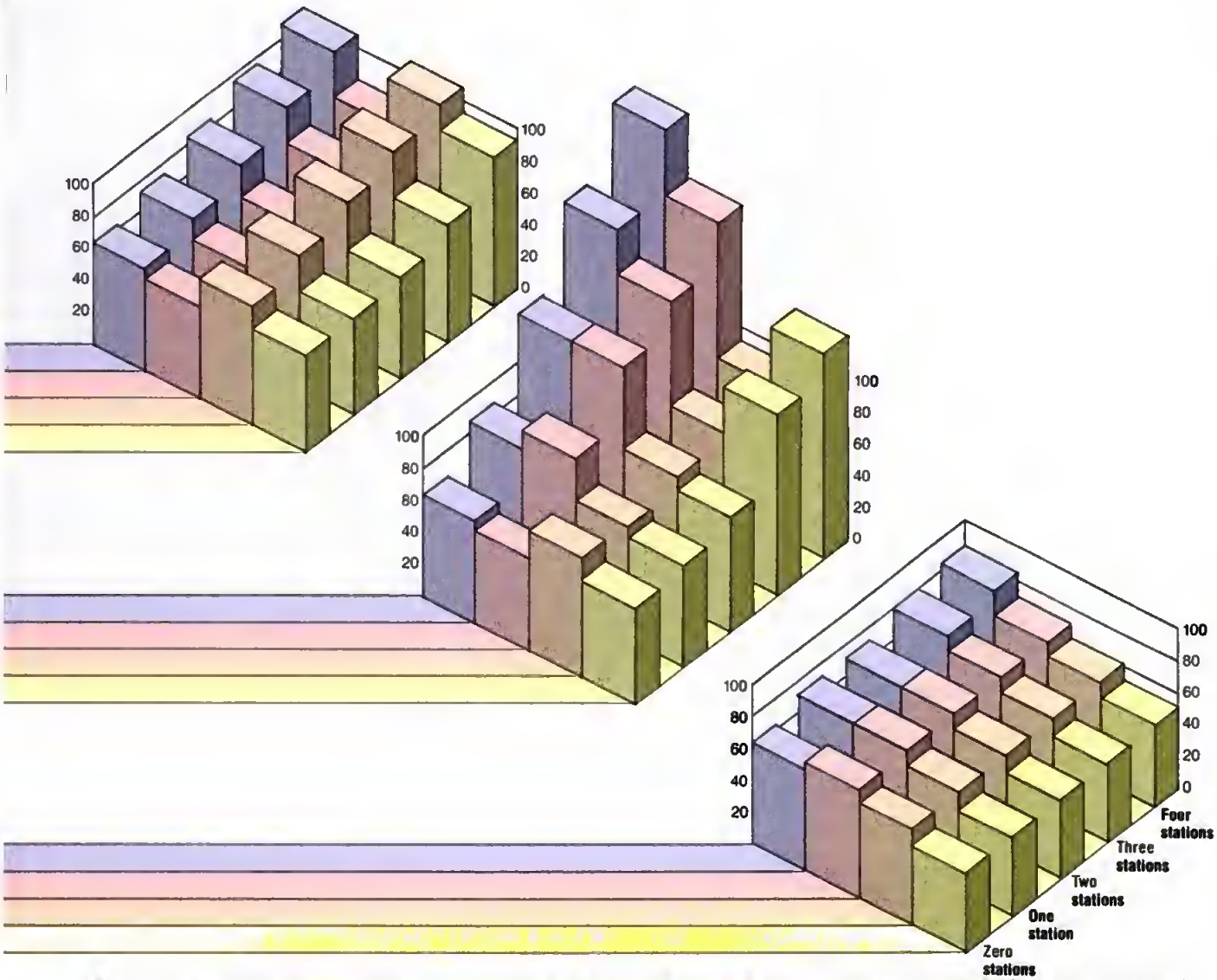
**Performance Times**
(Times given in seconds and decimal seconds)

| Interface cards | Software | Server | Zero stations | One station | Two stations | Three stations | Four stations |
|---|---|---|---|---|---|---|---|
| IBM Token-Ring | *PC Local Area Network* | 8-MHz IBM PC AT | 64 00 | 68 00 | 71 00 | 78 00 | 85 00 |
| IBM Token-Ring | *Advanced NetWare/286A* | 8-MHz IBM PC AT | 67 00 | 68 00 | 69 00 | 70 00 | 72 00 |
| NetWare/S-Net | *Advanced NetWare 68* | Novell Server 68B | 61.00 | 61 00 | 62 00 | 63 00 | 64 00 |
| ARCnet | *Advanced NetWare/286* | 8-MHz IBM PC AT | 47.00 | 49.50 | 49.50 | 50.50 | 50.50 |

PC Labs tested the IBM Token-Ring Network interface cards running under different software programs: IBM's *PC Local Area Network Program* and Novell's *Advanced NetWare/286A*. We used an 8-MHz IBM PC AT as the server for a network consisting of three IBM PCs, one IBM PC AT, and one IBM PC-XT as workstations. *PC Local Area Network Program* was configured according to parameters listed in the manual for a dedicated LAN server. Benchmark tests run on the same software operating in the shared server/workstation mode were much slower.

For comparison we have included the results of the benchmark tests for Standard Microsystems' ARCnet cards with the same server running under Novell's *Advanced NetWare/286* and for Novell's NetWare/S-Net cards using a specialized Motorola 68000 server. Reviews of these two products appeared in "Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21. ARCnet was the Editor's Choice in that issue. ARCnet and NetWare/S-Net servers were configured to operate only in the dedicated mode and not as dual-purpose server/workstations. The networking software was installed using the default configurations.

For both the **Network Speed Under Contention** and **Network plus Server Cruncher** benchmark tests, the dependent variable is the time it took for the IBM PC-XT on a LAN to perform a standard set of DOS read-write commands against a single data file residing in the server. The independent variable was the network load. We began with the heaviest load, four network workstations running DOS batch files, asking for constant reads of data




files from the server. Then we decreased the number of workstations one by one to reduce the network load.

The three-dimensional chart above shows the time it took the XT to perform the test under the varying network load on each network. For comparison, we give the time it took to run the same test on the XT's internal hard disk (Zero stations).

The difference between the Network Speed Under Contention test and the Network plus Server Cruncher test lay in the size of the data blocks that the workstations moved over the network.

The Network Speed Under Contention test exercises the network when the network interface cards and the media are heavily loaded. We attempted to eliminate the factor of server disk access time from this test by loading the network with data blocks small enough to reside in the server's cache memory on most systems. In addition, we varied the size of the data files to detect any cache limits.

The Network plus Server Cruncher test heavily loads the network interface cards, the media, and the server's disk drive access system. In this case we used data blocks of various sizes, some small, some large, when we loaded the network in order to exercise the hard disk drive access system. The results are influenced by hard disk performance and the efficiency of the networking software as it moves data on the disk and between the disk and the network interface cards.

During both of these tests, we used a hardware clock residing on an AST Six-Pak card in the XT to determine the starting and ending times. We did not use the system clock because its operation can be disturbed by some network functions.

The *Smart* series of integrated networked programs from Innovative Software gave us a practical way to evaluate networks under the load of typical applications. In fact, viewed on a system monitoring screen, such as *NetWare*'s, the **Smart Applications** benchmark test looks and acts like a busy office, because the level of activity varies between intense use of the network and quiet periods when processing takes place.

For the department variable plotted on the three-dimensional chart, we used an IBM PC-XT operating Innovative Software's *Smart DBMS* running a script file that indexed and sorted shared database records. The independent variable was one through four workstations running another script from Innovative Software that created bursts of activity interspersed with periods of silence.

## IBM Token-Ring Network: Summary of Features

| PRODUCT/ Manufacturer/ Software | Installation: Turnkey | Installation: Menu-driven | Installation: Documentation | Network Administration: Hours per month | Network Administration: Status reporting | Network Administration: Security | Network Administration: Workstation operation | Features: Station-to-station file transfer | Features: Printer spooling/ queuing | Features: Peer-to-peer communications | Features: Network dial-in | Compatibility: RAM-resident software | Compatibility: Smart software | Compatibility: dBASE III Plus | Compatibility: R:base Series 5000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **IBM Token-Ring Network**<br>IBM Corp.<br>*PC Local Area Network Program* | ■ | ■ | ■ | 1.00 | | ■ | ■ | ● | ■ | ■ | ● | ● | ● | ● | ● |
| **IBM Token-Ring Network**<br>IBM Corp<br>*Advanced NetWare/286A* | ○ | ■ | ■ | 1.00 | ■ | ■ | ■ | ○ | ■ | ■ | ● | ● | ● | ● | ● |
| **NetWare/S-Net**<br>Novell Inc<br>*Advanced NetWare 68* | ○ | ■ | ■ | 1.00 | ■ | ■ | ■ | ○ | ■ | ■ | ● | ● | ● | ● | ● |
| **ARCnet**<br>Standard Microsystems Corp<br>*Advanced NetWare/286* | ○ | ■ | ■ | 1.25 | ■ | ■ | ■ | ○ | ■ | ■ | ● | ● | ● | ● | ● |

Indicates Editor's Choice ● = Yes ○ = No

Excellent— ■■■ Good— ■■ Fair— ■ Poor— ▬

The features of network systems are determined largely by the networking software. For a description of the method we used to evaluate each feature, see "Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21. The IBM Token-Ring Network running under *PC Local Area Network Program* was easy to install and maintain. Although its station-to-station message utility is good, the program cannot send store-and-forward electronic mail. Its security and troubleshooting features do not compare well with those of other popular networking programs. For comparison, the table includes Standard Microsystems' ARCnet—an Editor's Choice—and high-scoring Novell's NetWare S-Net, both running under *Advanced NetWare*.

Installing IBM's *PC LAN* software is a smooth operation. The process involves putting the Starter Kit Installation Aid Diskette into drive A: of the server and typing INSTALL. Then you feed five disks into the drive in response to directions on the screen.

We experienced a problem, however, using the Install program with the 1.2-megabyte floppy disk drive in an 8-MHz PC AT. The installation program could not complete its task because the *PC LAN* diagnostics disk insisted on booting and taking over the system instead of just allowing its files to be copied. We suspect that the IBM installation program was not developed with the 8-MHz AT in mind. We installed the networking software on a PC-XT and then transferred the files to the AT by temporarily running the XT on the network as a server and the AT as a workstation. After that backward transfer, everything worked well.

Anyone planning to use the IBM Token-Ring system should consider the fact that *PC LAN* is hungry for RAM. A workstation on the Token-Ring loses 121K bytes of RAM to the networking software. Users who load their machines with RAM-resident programs or who use large spreadsheets can suffer from the loss of this much workspace, even when using a 640K-byte RAM machine. Loading some memory-resident pieces of *PC LAN*, such as the menus, should be optional, but we couldn't find a way to keep them from loading. (We haven't yet seen a patch to keep the *PC LAN* menus from loading. Power users, where are you?)

**SOFTWARE SHARING** An important difference between the IBM networking software and most of the other LAN software on the market is the ability of stations on the IBM system to act simultaneously as a workstation and a server. Even if you use a workstation primarily to run local programs, you can choose to allow others on the network to share a disk drive or a printer on your machine. This may sound like a significant advantage, but it has a price.

Sharing a station's resources with the network is done by time-slicing the PC's processor—in effect, dividing the processor's attention between local jobs and the network. You can determine what the ratio of the time slice is, and if you are doing jobs where the CPU isn't very busy, this sharing can work well. But in many networks, workstation users find they miss the processing time they give away to the network.

A server on the Token-Ring Network is much more efficient when it acts as only a server and not also as a shared workstation. But the *PC LAN* software does not optimize the server software for dedicated operation. Network memory buffers and time-slicing parameters are loaded in a mode designed for dual workstation-server operation. Consequently, some of our heavy system-loading benchmark tests took nearly 15 minutes to run, as compared to the more-typical times of 1 to 4 minutes.

IBM's emphasis on the shared role of network nodes led us to modify one of our

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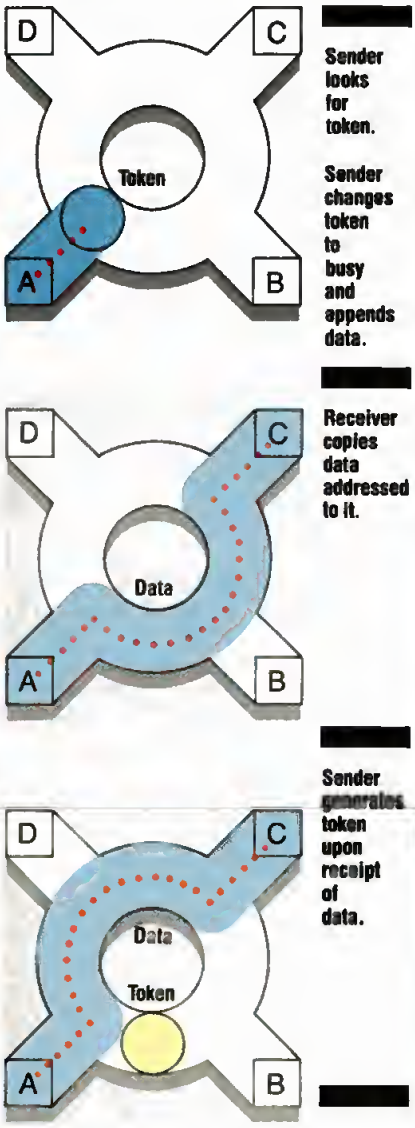
## Token-Ring Access Protocol

In the token-ring access scheme, a single token circulates among the stations when all are idle. When a station wishes to transmit a message, it waits until it receives a token. It then changes the token from a free token to a busy token. The station transmits a block of data, called a frame, immediately following the busy token. No other stations can transmit when the token is busy. The receiver copies the data addressed to it, and the frame continues on the ring back to the transmitting station. The transmitting station purges the data and inserts a new free token on the ring when it has finished transmitting its frame and the busy token has returned.




evaluation rules. We felt it was not fair to compare the shared mode of operation in the IBM system with the dedicated mode server software we benchmark-tested previously. In the previous tests of other LAN systems, we avoided fine-tuning the software to improve benchmark test performance and used only default settings. But in the Token-Ring Network evaluations, we followed the instructions in the IBM manual describing the settings to use for a dedicated server. Following these instructions reduced some benchmark test times from 15 to 4 minutes.

**SOFTWARE FEATURES** The two major categories of functions you can perform with *PC LAN* are *sharing* disks, directories, files, or devices such as printers and *exchanging* messages with other workstations. Some other tasks are directly related to network operation, such as checking network status and controlling network operations.

The *PC LAN* command called Net Share allows you to share whole disk drives or specific directories on a disk with other network stations. You can even share a single file with the network by putting it into its own directory. You also use Net Share to indicate that a printer connected to a specific port on your workstation or server is available to the network.

The corollary command to Net Share is Net Use. This command links a drive or a device designator on a specific PC workstation with a drive or device being shared with the network. When you give the command NET USE D:\\SERVER1\DATABASE, the directory called DATABASE on the server named SERVER1 becomes your D: drive. The same kind of command line could link a device such as your LPT1 to the LPT1 on the server. The Net Use command can include a password if the person sharing the resource specified that a password was needed in the Net Share command.

The Net Path command serves the same function as the Path command in DOS: it provides a path for an applications program to follow to find its data files. The format is the same as that of the DOS command, except that workstation names can be a part of the path. In this way an applications program running from a disk in your own workstation can find a data file on a machine acting as a file server.

If different shared drives, directories, and devices are located on many different network machines, some form of fast intranetwork communications is a necessity for practical operation. It is helpful to be able to ask someone at a workstation with a shared printer to check the paper or to hold a document that was just printed, and to be able to ask that a file be made available or if the available version is up to date. You need to pass these messages in real time and not through a store-and-forward electronic mail system. You could call the person on the phone, but then you would have to know the number of every phone near every workstation. A type of keyboard-to-screen transmission, generically called rude messaging or real-time messages, helps in these situations.

Rude messaging interrupts the activity of the workstation receiving a message. *PC LAN* has an excellent rude-message system. You can send messages of up to 1,600 characters to any specific workstation on the network and broadcast messages of up to 128 characters to every workstation. The broadcast mode is useful, for instance, if you have a printer or a disk shared with the network and you want to tell everyone on the network that you are turning off your workstation.

*PC LAN* allows you to check a print queue to see where your job is, and it provides a display telling you what drives and devices are available to network users. No *PC LAN* displays give any status reports on the network load or activity. Any management and troubleshooting tools have to be added as third-party products.

**SECURITY** *PC LAN* does not compare well to Novell's *NetWare* in the area of security. First, anyone who can physically get to a *PC LAN* server can access, erase, or change any files on the server. Novell's *NetWare* prevents access to the server disk except through the access security program. Any administrator of a Token-Ring Network using *PC LAN* should seriously consider the physical security of the server. Minimal measures include locking the hard disk and removing the keyboard.

In addition, *PC LAN* has only three categories of user file privileges: read, write,

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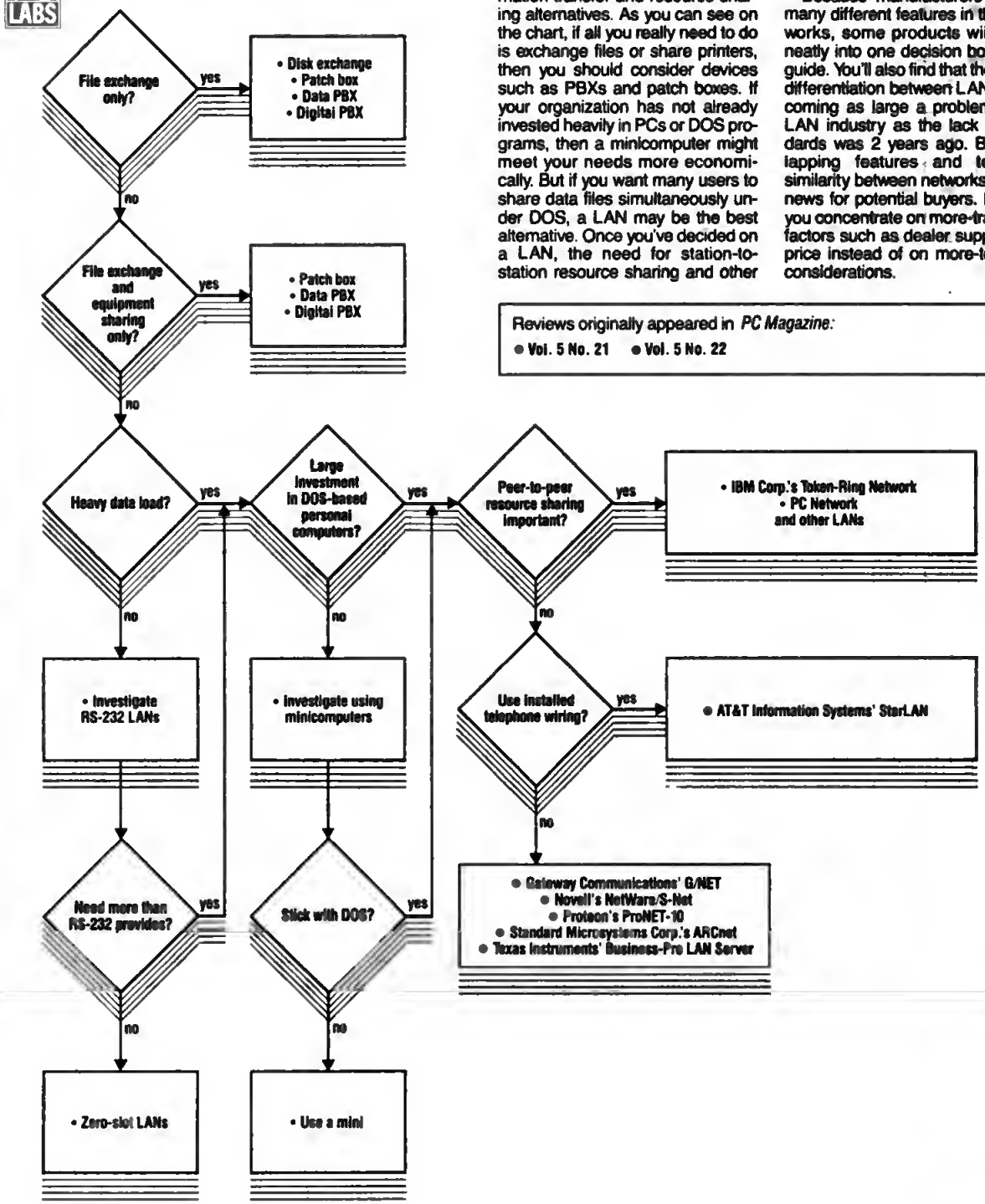
## The Connectivity Decision Guide

This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks is good news for potential buyers. It will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

Reviews originally appeared in *PC Magazine:*
● Vol. 5 No. 21 ● Vol. 5 No. 22



■ Companies selling LAN products must consider providing versions for the IBM Token-Ring, if only because of the marketing power of the IBM name.

and create. *NetWare* and other network programs add sharper definitions of privileges such as modify, open, and search. Each of these privileges has a useful role to play in providing security for sophisticated industrial or institutional file systems.

**USING THE RING** The Net Share and Net Use command lines described above are examples of how a power user or a network administrator controls the system. Less-skilled persons don't have to know about commands like these to use the system. Typically, the network administrator would put those commands into the AUTOEXEC.BAT file for each workstation or into a batch file with a descriptive name like SAMDISK. Users have to run only the batch files to have all the commands entered.

Alternatively, IBM provides a set of menus that pass the proper commands to the *PC LAN* program. The menu headings include Message Tasks, Printer Tasks, and Disk or Directory Tasks. Various submenus step you through the alternatives needed to share and use devices on the network. These menus are effective for casual users, but most novice users would be happier with batch files, and expert users will want to enter their own commands.

**BEST CHOICE?** Is the IBM Token-Ring Network the best choice for a corporate or institutional LAN buyer? The PC Labs evaluation team is sure no one is ever going to be fired for buying the IBM Token-Ring. The system is supported not only by IBM, but also by companies such as Novell, Ungermann-Bass, Nestar, and 3Com, who have announced or released Token-Ring-compatible products. Every company selling products in the LAN marketplace must consider providing versions of their products for the IBM Token-Ring, if only because of the marketing power of the IBM name. But in addition, the system performs well.

Our main complaint concerns *PC LAN*'s lack of built-in troubleshooting and diagnostic reporting tools. As compared to using systems like Novell's *Advanced NetWare*, Banyan's *VINES*, or Fox Research's *10 Net*, a network administrator on the Token-Ring Network is flying in the dark. IBM's marketing strategy may be to sell its $2,000-plus hardware-consuming *Netview/PC* system to supply the missing tools, but we are confident that other companies will soon offer good diagnostic and management tools for Token-Ring Network systems.

In sum, we found the IBM Token-Ring Network hardware to be a powerful system and the IBM *PC Local Area Network Program* software to be both flexible and fast. Together these industrial-strength products have both the technical power and the industry support to capture and hold a large share of the LAN market.

After looking at all eight networks reviewed here and in the previous two issues of *PC Magazine*, though, we have concluded that the ARCnet hardware from Standard Microsystems Corp. running under Novell's *Advanced NetWare/286* is the best overall system. It has greater throughput than the IBM Token-Ring Network; the troubleshooting advantage of a centralized wiring hub, showing you what's going on as opposed to keeping you in the dark as the IBM system does; and the management and security functions of Novell's *Advanced NetWare/286*, surpassing those of *PC LAN*. Plus, it too has the IBM Token-Ring's advantage of running on a wide variety of AT-compatible servers. The IBM-Token-Ring Network is an industrial-strength network, but the ARCnet/*Advanced NetWare* combination is the top-performing network. PC

*Frank J. Derfler, Jr., is a contributing editor of* PC Magazine.

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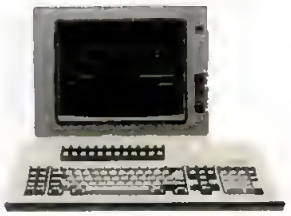

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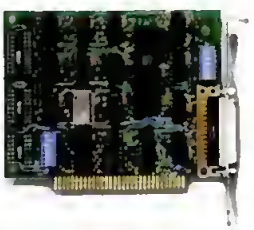

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CIRCLE 326 ON READER SERVICE CARD

REMOTE™

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1000 Holcomb Woods Parkway
Roswell, Georgia 30076

# MULTIDIMENSIONAL SPREADSHEETS

## GIVING DEPTH TO YOUR DATA

*There's more than one dimension to business, but until recently spreadsheet programs for the PC were limited to calculating your data in only two dimensions. Now you can use 3-D—or even 60-D—spreadsheets to get a deeper perspective.*

Traditional spreadsheets represent the world in two dimensions. Within the confines of two axes, they give us lots of room in which to make calculations. But the business world isn't two dimensional, and spreadsheets are finally catching up. We review five spreadsheets—*VP-Planner*, *CalcIT*, *Boeing CALC*, *TM/1*, and *micro-CUBE*—that offer a multidimensional perspective.

What is a multidimensional spreadsheet? While a traditional spreadsheet is composed of rows and columns, a three-dimensional spreadsheet has rows, columns, and pages. Three dimensions aren't even the upper limit: one of the spreadsheets reviewed here, *VP-Planner*, offers 5 dimensions, and another, *TM/1*, can access an incredible 60. But you don't have to be another Einstein to envision this universe; the concept is not that complicated or even unfamiliar. In fact, it reflects the way you already think about business.

A typical two-dimensional spreadsheet might list all your expense categories down the left side of the screen and the months of the year across the top. You could then check your telephone expenses, for example, for January, February, or any other month. A Totals column at the far right could give you total telephone expenses for the year. Across the bottom of the spreadsheet you'd see the totals of all expenses month by month, with a grand total for the year in the lower-right-hand corner.

But suppose you want to compare telephone expenses over a 5-year period. Now you need five two-dimensional spreadsheets, and you'll have to link them if you want to get totals for the 5 years under consideration.

Instead, you can use one three-dimensional spreadsheet. Copy the structure of the spreadsheet onto four other pages behind the first, creating a page for each of the 5 years. Formulas can total the data from spreadsheet cell C48 from each of the five pages onto a sixth for a summary.

Let's say the company has five regional offices, with three salespeople in each. You'd like to be able to compare the telephone expense for each office for any month of any year and know which salesperson is running up the highest phone bills.

That's what additional dimensions let you do: organize and analyze your data by whatever criteria are appropriate to your business. With a multidimensional spreadsheet, you could select telephone expense data from January 1986 for your Kansas City office by salesperson. If you run out of dimensions, you can link multidimensional spreadsheets, too.

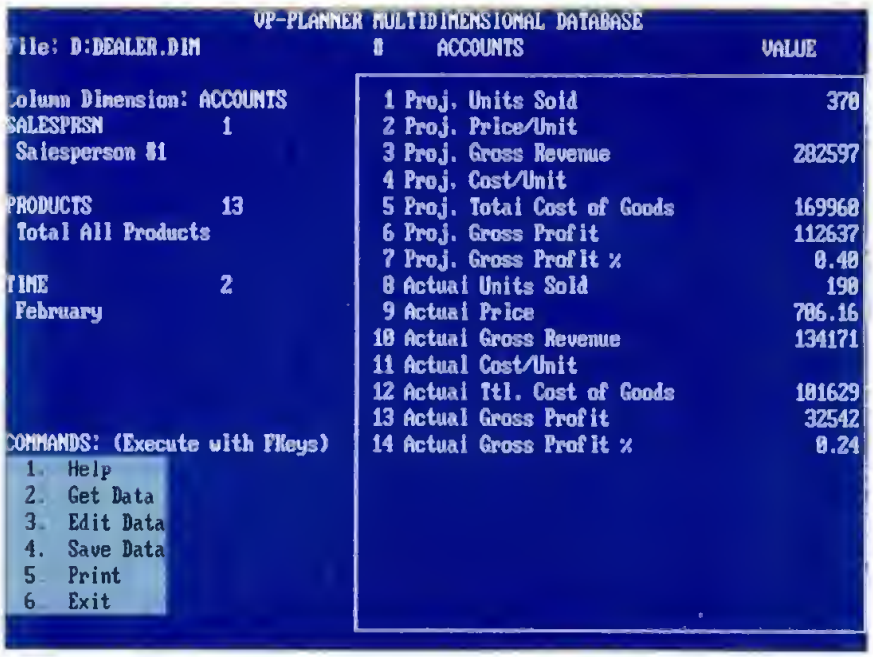
## VP-Planner

Although *VP-Planner*, Version 1.2, from Paperback Software International, has achieved fame as a Lotus clone, its *1-2-3*–like spreadsheet was originally developed as a convenient adjunct to its multidimensional spreadsheet. Basically the latter resembles its competitor, *TM/1*, in that it stores data in tables, but its structure is more rigid and limited. However, considering *VP-Planner*'s bargain-basement price of $99.95, it would be uncharitable to complain too much about its shortcomings.

*VP-Planner*'s five dimensions are labeled Time, Accounts, Products, Markets, and Divisions by default. Of course, you can rename any or all of these according to your needs. You can retrieve all the figures for any two dimensions at once, plus the data relating to one category of each of the three other dimensions.

The program is copy protected (the protection scheme requires you to have the original program disk in your A: drive while you're using the software), but an extra $10 will get you a nonprotected version. There's a $5 minimum charge for telephone support, plus $1 per minute after the first 5 minutes.

On the opening menu, the first option is Worksheet Only, which will take you into the two-dimensional spreadsheet. This spreadsheet uses the same commands as *1-2-3* in the same ways, with a few added features for good measure. You can even change the colors of the worksheet, and you can record macros as you would in *Symphony*.




VP-Planner's *Browse mode is the easiest way to view its multidimensional files. The program lets you use up to five dimensions and also functions as an inexpensive* 1-2-3 *clone.*

Another menu option gives you a directory listing, and a third option lets you quit and return to DOS. The remaining three selections all deal with the multidimensional worksheet. One option sets the path for multidimensional files, a second—the multidimensional database—lets you create or edit the tables, and the final option gives you the worksheet combined with the database for retrieval and analysis.

Your first step is to create the database that will hold your information. These multidimensional files receive an automatic .DIM extension and are easy to create by following menus and screen prompts. First you name the database, then you build the structure. You're asked the number of dimensions and the number of places to be shown to the right of the decimal point for Rates and Amounts. These two categories are actually part of the second dimension, Accounts, intended to be the bookkeeping module of the database. The first category, rates, is for figures such as sales tax rates that will not be totaled across Time, the first dimension. Amounts is for all the other numbers, such as salaries or sales volume, that you would want totaled.

Next you name your dimensions, or accept the defaults. You must also establish the categories for each dimension. If one of your dimensions is Regions, the categories might be Eastern, Southern, and Western. You establish the necessary logic statements for each category with the appropriate equations or formulas. Multiplication, division, and the use of constants are permitted only in the second dimension, Accounts. Any dimension may include addition or subtraction. In the Accounts dimension, each category must be identified as a Rate or an Amount. The Amounts are either Budget or Actual figures.

When you finish, you can print out the structure and logic. The program will point out any errors you may have made in the formulas, such as a misspelled category name.

Now comes the hard part. Although you can look at your data through a /Data External Multidim Browse command, before you do any serious analysis or enter data, you must set up linking cells between the database and a worksheet. There are two kinds of links: label links and data links. Also, you must define copy ranges and set up separate tables through reference cells for both entry and retrieval. To complete this process successfully, it's absolutely essential to study the manual. Unfortunately, the manual contains very little

PC MAGAZINE FACT FILE

***VP-Planner*, Version 1.2**
Paperback Software International
2830 Ninth St.
Berkeley, CA 94710
(415) 644-2116
(415) 644-8249

**List Price:** $99.95
**Requires:** 256K RAM, two disk drives, DOS 2.0 or later.
**In Short:** As a *1-2-3* clone, this inexpensive, 2-D spreadsheet is wonderful, but its multidimensional feature (up to five dimensions) is hard to use. Copy protected (nonprotected version available for $10 more).

CIRCLE 645 ON READER SERVICE CARD

information about using the worksheet for analysis; its emphasis is on entry and retrieval procedures.

You can combine *dBASE* files with your multidimensional files, create graphs, and import or export complete *dBASE* or *1-2-3* files, as well as data in DIF or ASCII formats. The maximum multidimensional file size in *VP-Planner* is 17 megabytes, thanks to virtual memory. The program matches the *1-2-3*, Release 1A, list of functions.

*VP-Planner* is a great buy as a *1-2-3* clone (see "1-2-3 Knockoffs: How Close Do They Come?" in *PC Magazine*, Volume 5 Number 17), but making its multidimensional module work requires a lot of effort and knowledge.

## CalcIT

Martin Marietta Data Systems' entry in the multidimensional sweepstakes is *CalcIT*, Version 2.4. Although it can operate with a database program called *KeepIT*, *CalcIT* also works as a standalone product.

*CalcIT* calls its spreadsheet a DataCube; the DataCube's maximum dimensions are 255 columns by 255 rows by 255 pages. It's held entirely in RAM, so if you have less than 640K, you'll have to settle for smaller spreadsheets. Since the largest spreadsheet would be the equivalent of some 3,000 typewritten pages, a more modest size will probably serve your needs. A hard disk is not required, and the program can get by on 128K RAM.

PC MAGAZINE FACT FILE

CalcIT

***CalcIT*, Version 2.4**
Martin Marietta Data Systems
P.O. Box 2392
Princeton, NJ 08540
(800) 222-5175
(609) 799-2600
**List Price:** $275
**Requires:** 128K RAM, two disk drives, DOS 2.0 or later.
**In Short:** An interesting 3-D spreadsheet but with significant import/export limitations. Overdue for an update. Not copy protected.

CIRCLE 644 ON READER SERVICE CARD

There's no support for the 8087 math coprocessor, and the program calculates and rounds to only nine digits. However, *CalcIT* offers interesting advantages in other areas. For instance, you can change your view of the spreadsheet. Let's say you're showing sales by product in your rows, with the columns representing time periods and the relevant data for each regional office stored on the pages. If you'd like to compare the sales of the regional offices, you can issue a command that will switch the display so that the columns show the regional offices and the pages show the time periods. McDonnell Douglas's *microCUBE* also offers this feature.

Although *CalcIT*'s spreadsheet looks like a *1-2-3* spreadsheet at first glance, it's actually very different. Rows are numbered with three digits, starting with 001. Five highlighted blocks appear at the bottom of the screen: Help, Run, Print, Load, and Save. These commands are assigned to the F1, F3, F5, F7, and F9 keys. The Run command runs an .EXEC file, a template, or an application created with a powerful macro language that's part of the program.

In cell addresses, pages are indicated as letters, and the page appears after the col-

## WHAT ARE THESE AIRPLANE BUILDERS DOING IN THE SOFTWARE BUSINESS?

Three of the marketers of the multidimensional spreadsheets reviewed here are firms prominent in the aerospace industry. In fact, each incorporates the name of a famous aviation pioneer in its company name.

Glenn Martin built the legendary Clipper flying boats in the late 1930s; his name survives in Martin Marietta. Bill Boeing developed the B-17 and the B-29 of World War II fame; the corporation that built the planes bears his name. Donald Douglas spawned the DC-3; his company became part of McDonnell Douglas. How did these aerospace giants get into the business of selling software?

At both Boeing and Martin Marietta, computer expertise was developed first on mainframes for internal requirements and later sold to outside customers. Martin Marietta Data Systems was formed to coordinate and sell that company's services; this division now has a microcomputer products group. Its principal product is a line of programs with *IT* in their names (*CalcIT*, *KeepIT*, and so on). Some of these programs were created for Martin Marietta by outside suppliers. Organizations with larger computers tend to be familiar with Martin Marietta's RAMIS and 4000 Series products, as well.

In 1969 Boeing had 13 separate data centers in the Puget Sound area, each with a different approach and separate management. As you would imagine, many cases of incompatibility surfaced between the systems. Boeing Computer Services was formed in that year to consolidate the centers, with initial hardware worth $100 million and a staff of 2,000.

The restructuring was a success. In the 1970s the division began marketing its capabilities to the business community. They now sell software for the manufacturing, engineering, business, education, and training fields adaped to mainframes, minis, and PCs—including the spreadsheet program, *Boeing CALC*, reviewed here. By 1985 Boeing was the leading vendor to the Federal government of data services purchased through the General Services Administration.

McDonnell Douglas is a different case. Although not well known to the public, its McDonnell Douglas Communications has been serving the telecommunications industry for over 20 years and is the leading outside service supplier of computer systems and software to AT&T and the former Bell System companies. Its three-dimensional spreadsheet, *microCUBE*, which includes a telecommunications module, grew out of the needs of its clients.—**Marvin Bryan**

umn and row. For example, P:A1A represents the Home position on the first page. The initial P means that you have the page view of the data rather than the column or row view.

The Slash (/) key invokes menus, and *CalcIT* offers some interesting choices. The command /GDN (for global display nocoordinates) eliminates the display of the spreadsheet borders and can be used to print out a report from the screen. If you enter the /FH (for format horizontally) when the cursor is on any cell in column A, the text in that cell will be centered on the screen.

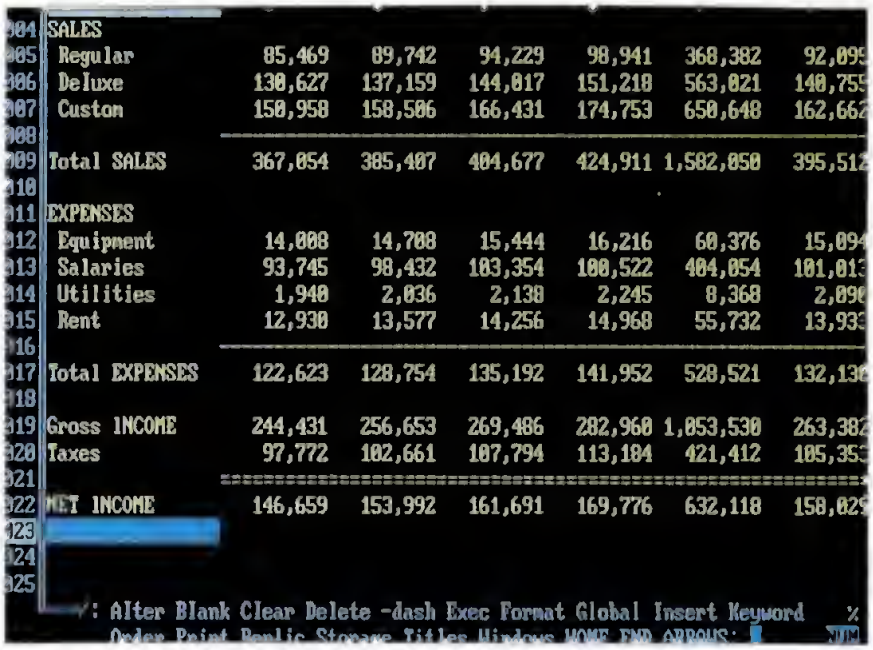
In the automatic recalculation mode you can continue to type while the program recalculates. It will do its figuring between your keystrokes.

You have to be careful when dealing with *CalcIT*'s importing capabilities. First, it can handle only ASCII and DIF files and will import only data, not formulas. You must preset the columns of the *CalcIT* file that will receive the data to make them as wide as or wider than the columns in the file to be imported. Otherwise, the imported data will be truncated to fit. This restriction is not unusual in transferring data from one software package to another, but *CalcIT* imposes other limitations as well. When you import an ASCII file, *CalcIT* converts any number larger than nine digits into a text entry. If the file is in DIF format, only the first nine digits of the number will be transferred, no matter what the size of the receiving cell. Dates are converted into numbers. Formulas in scientific notation are not accepted.

You can split the *CalcIT* screen into as many as four windows. These can be sychronized if desired. You can also freeze title areas so they won't scroll.

*CalcIT* has limited graphics capabilities. A file called AUTOGRAP.H will let you enter data in a box on the left side of the screen. Built-in formulas in the worksheet scale a bar chart on the right side to match the data. You can write titles and explanations anywhere you like, and you can even display titles sideways.

You can also insert a graph into your spreadsheet, but doing so is a difficult process that involves complicated formulas and commands for moving data, scaling the graph, programming in graphics symbols, and linking the graph to the spreadsheet. If the spreadsheet is one you'll reissue every month with updated figures, the routine might be worth the effort.



| | | | | | | |
|---|---|---|---|---|---|---|
| SALES | | | | | | |
| Regular | 85,469 | 89,742 | 94,229 | 98,941 | 368,382 | 92,09 |
| Deluxe | 130,627 | 137,159 | 144,017 | 151,218 | 563,021 | 140,75 |
| Custon | 150,958 | 158,506 | 166,431 | 174,753 | 650,648 | 162,66 |
| Total SALES | 367,054 | 385,407 | 404,677 | 424,911 | 1,582,050 | 395,51 |
| EXPENSES | | | | | | |
| Equipment | 14,008 | 14,708 | 15,444 | 16,216 | 60,376 | 15,09 |
| Salaries | 93,745 | 98,432 | 103,354 | 108,522 | 404,054 | 101,01 |
| Utilities | 1,940 | 2,036 | 2,138 | 2,245 | 8,360 | 2,09 |
| Rent | 12,930 | 13,577 | 14,256 | 14,968 | 55,732 | 13,93 |
| Total EXPENSES | 122,623 | 128,754 | 135,192 | 141,952 | 528,521 | 132,13 |
| Gross INCOME | 244,431 | 256,653 | 269,486 | 282,960 | 1,053,530 | 263,38 |
| Taxes | 97,772 | 102,661 | 107,794 | 113,184 | 421,412 | 105,35 |
| NET INCOME | 146,659 | 153,992 | 161,691 | 169,776 | 632,118 | 158,02 |

: Alter Blank Clear Delete -dash Exec Format Global Insert Keyword

CalcIT*'s spreadsheet, which it calls a DataCube, bears a strong outward resemblance to* 1-2-3, *but its conventions are often very different. Its procedures and commands, however, are efficient.*

*CalcIT*'s financial functions include amortization, present value, and payment for annuity due. The program can also perform basic statistical procedures plus rudimentary linear regression and trend-line algorithms.

The lengthy manual is thorough, and technical support is free. *CalcIT* is reasonably priced and friendly but long overdue for an update.

## Boeing CALC

*Boeing CALC*, Version 3.00, from Boeing Computer Services, can import a functioning *1-2-3* or *Symphony* spreadsheet in a matter of seconds. You get formulas that work, formatting, and even varying-width columns exactly as they were in the original. But because of differences in the command structure, you'd probably have to modify macros.

*Boeing CALC*'s commands are similar to those in the Lotus programs, and you don't have to step into the third dimension unless you want to. But there's no linking involved when you do; the relationship is already there.

You need a hard disk to run *Boeing CALC*, which is not copy protected. You get up and running by using an INSTALL batch file; don't try to bypass this procedure by using the DOS COPY command. Among other chores, the batch file concatenates separate parts of a program file that's too large to fit on a single floppy.

After installation, type BCALC to load the package, and you'll see a blank spread-

PC MAGAZINE FACT FILE

***Boeing CALC*, Version 3.00**
Boeing Computer Services,
Software, and Education Products Group
P.O. Box 24346, M.S. 7K-10
Seattle, WA 98124-0346
(800) 551-0800, ext. 12
(206) 763-5000, ext. 12
**List Price:** $399
**Requires:** 384K RAM, hard disk, DOS 2.0 or later.
**In Short:** A 3-D spreadsheet that imports functioning *1-2-3* and *Symphony* worksheets and uses *1-2-3*–like menus. Friendly and efficient, it can also handle huge files. Not copy protected.

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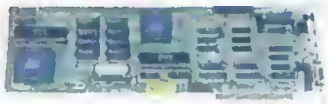

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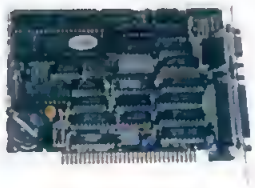

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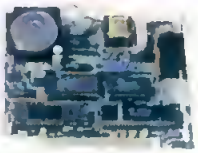

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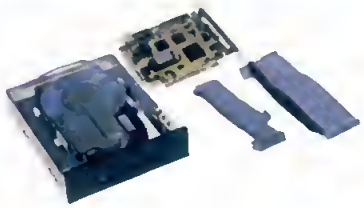

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sheet that looks very much like *1-2-3*. The default filename SCRATCH.PAD appears at the bottom of the screen. Boeing calls its spreadsheet a workpad—a designation that implies three dimensions since pads have depth in the form of pages as well as length and width. *Boeing CALC* files are saved with a .PAD extension.

Pressing the F4 key will toggle you back and forth between page mode and pad mode. Once in page mode, pressing PgDn shows you a lower portion of the same spreadsheet page you're looking at. In pad mode, however, pressing PgDn takes you into the third dimension, where you can scroll through the pages of your workpad.

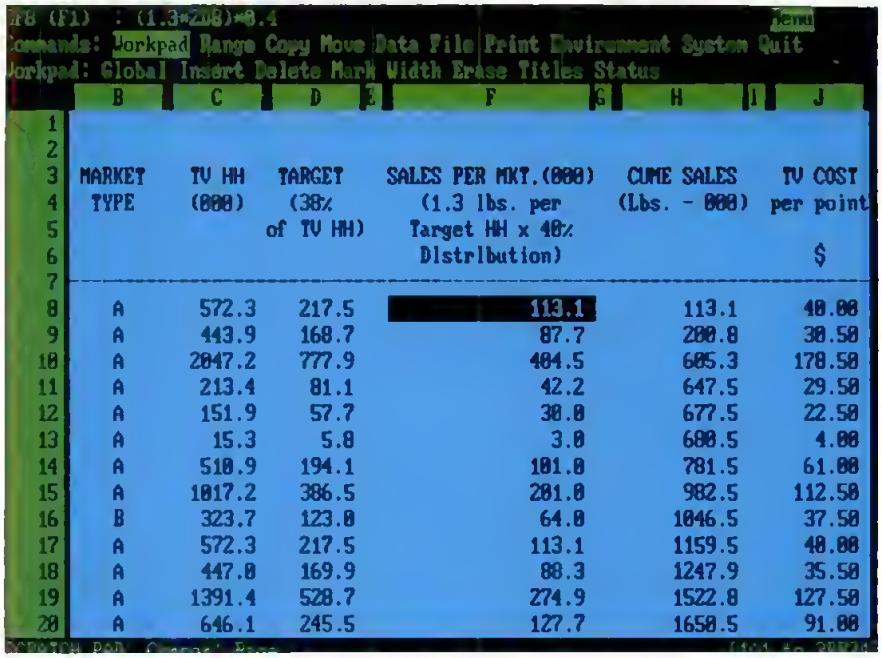
The other clue indicating that *Boeing CALC* has a three-dimensional nature is the way it identifies cells. The page number precedes the cell cross-references in the address; hence the cell in the Home position on page 1 is designated 1A1 and the cell in the same position on page 2 is 2A1.

Menus are called up with the slash (/) key as in *1-2-3*, and most of the commands are familiar enough that *1-2-3* users will be able to find their way around without referring to the manual.

Instead of trying to store a large worksheet entirely in RAM, *Boeing CALC* uses virtual memory. If you have the disk capacity available, you can create a single file as large as 32 megabytes. It can contain as many as 16,000 rows, 16,000 columns, and 16,000 pages in one workpad. *Boeing CALC* has 14 financial functions as well as the customary mathematical algorithms. Statistical functions parallel those of *1-2-3*, Release 1A, and there is no linear regression in any form.

*Boeing CALC* offers a unique windowing feature that freezes the current screen display and allows you to scroll with your cursor to off-screen spreadsheet cells or pages. The only element that changes on your monitor is the edit line for the cursor. As you scroll, the edit line will reflect the contents of each cell it passes. You can use the feature to locate a figure or formula elsewhere without altering your current position in the workpad.

The Titles command, reminiscent of the way Lotus's *Symphony* handles titles, will lock vertical and/or horizontal labels, thereby letting you scroll a large workpad and still retain all of the labels as borders to identify your rows and columns.



| | B | C | D | F | H | J |
|---|---|---|---|---|---|---|
| 3 | MARKET TYPE | TV HH (000) | TARGET (38% of TV HH) | SALES PER MKT.(000) (1.3 lbs. per Target HH x 40% Distribution) | CUME SALES (Lbs. - 000) | TV COST per point $ |
| 8 | A | 572.3 | 217.5 | 113.1 | 113.1 | 40.00 |
| 9 | A | 443.9 | 168.7 | 87.7 | 200.8 | 30.50 |
| 10 | A | 2047.2 | 777.9 | 404.5 | 605.3 | 170.50 |
| 11 | A | 213.4 | 81.1 | 42.2 | 647.5 | 29.50 |
| 12 | A | 151.9 | 57.7 | 30.0 | 677.5 | 22.50 |
| 13 | A | 15.3 | 5.8 | 3.0 | 680.5 | 4.00 |
| 14 | A | 510.9 | 194.1 | 101.0 | 781.5 | 61.00 |
| 15 | A | 1017.2 | 386.5 | 201.0 | 982.5 | 112.50 |
| 16 | B | 323.7 | 123.0 | 64.0 | 1046.5 | 37.50 |
| 17 | A | 572.3 | 217.5 | 113.1 | 1159.5 | 40.00 |
| 18 | A | 447.0 | 169.9 | 88.3 | 1247.9 | 35.50 |
| 19 | A | 1391.4 | 528.7 | 274.9 | 1522.0 | 127.50 |
| 20 | A | 646.1 | 245.5 | 127.7 | 1650.5 | 91.00 |

Boeing CALC*'s spreadsheet will seem familiar to* 1-2-3 *users, especially its menus and command structure. Here, the worksheet is in Page mode; you would toggle into Pad mode to take advantage of the spreadsheet's third dimension.*

If you have a color monitor, *Boeing CALC* lets you use color to improve the program's aesthetics or to make your workpads easier to read. You can select the foreground and background colors you'd like to work with, and you can also establish different colors for the part of your spreadsheet that you'd like to emphasize. Further, you can specify highlighting and even underlining.

Besides importing *1-2-3* and *Symphony* files, the program can import and export data in both DIF and ASCII formats. You can set up security passwords for any file. *Boeing CALC* supports the 8087 chip and will calculate accurately to 12 digits.

*Boeing CALC* comes with an excellent on-line tutorial and a comprehensive manual, but *1-2-3* and *Symphony* users will have little trouble using *Boeing CALC* even without consulting the documentation. The company furnishes a sticker you can attach to your computer that lists toll-free numbers you can call if you need help.

Boeing Computer Services does not yet market a graphics module, but mainframe and LAN versions are available.

*Boeing CALC* is simple, accurate, reliable, and, at $399, relatively inexpensive. One of its greatest advantages is the ability to import and export *1-2-3* spreadsheets in working order; the competition can't do that.

## TM/1

Sinper Corp.'s *TM/1*, Release 2.0, is a different breed of spreadsheet, if you can call it a spreadsheet at all. It generates three categories of files: worksheets, dimensions, and tables. You don't store data on your spreadsheet but in a table—hence the initials TM for tables manager.

You might call the worksheet the display area. That's where you specify the tables for retrieval, the dimensions by which you want to view them, and the formulas to analyze them. In a typical application, one of your dimensions might be your regional offices; another would be the months of the year. Sums or weighted sums can be calculated in these dimension files. You could set up the months dimension so that any figures brought in from tables would be shown by the month, but also totaled quarterly and annually. A dimension for sales could include cells programmed to show monthly averages.

From the opening menu, *TM/1* is unlike any spreadsheet you've ever seen. The menu presents the structure of *TM/1* in graphic form, offering Worksheets, Ta-

# ACHIEVING MULTIDIMENSIONALITY WITH 1-2-3

*Three options for giving 1-2-3 the illusion of multidimensionality—including Lotus's clever HAL, a RAM-resident utility that makes up for what 1-2-3 lacks.*

Let's face it, Lotus Development Corp.'s *1-2-3* is not a multidimensional spreadsheet, although three options allow you to access more than one file at a time, creating an illusion of three-dimensionality. A few *1-2-3* commands let you combine files. Going a bit further, a utility called *X-Y-Z:Consolidate* from Intex Solutions can slice columns or rows from different spreadsheets and consolidate them into one file. And then there's Lotus's *HAL*, a RAM-resident utility that adds three-dimensionality to *1-2-3* plus more.

**1-2-3 COMMANDS** Without leaving *1-2-3*, the /File Combine command lets you leave the current worksheet on the screen and merge all or part of a stored .WK1 or .WKS file into the current worksheet at a location you specify with the cell pointer.

For instance, if you need to consolidate monthly expenses and you have more than one cost center, each on a separate worksheet, you can combine a named range or the entire worksheet into the consolidation. Let's say you want to add the telephone expense numbers from three branches. On each branch worksheet, save the expense in a range called TEL. Then, on the consolidated spreadsheet, use the /File Combine Copy command to copy the TEL ranges into an area where totals can be calculated.

When you select the /File Combine command, *1-2-3* prompts you with three menu options: Copy, Add, or Subtract. Copy replaces the current cell contents with the incoming data. When you execute the command, the location of the cell pointer will be in the upper-left-hand corner of the incoming range, and the incoming data will overwrite any cells. Add allows you to add numbers from one file to numbers from another without affecting the labels or formulas in the current worksheet. Subtract does exactly the opposite and treats any empty cell as if it were a 0.

After selecting the menu option, you must choose between an entire stored file or a prenamed range. If you choose an entire file, *1-2-3* will then prompt for the name of the file and will conveniently display the files that are available in the current directory.

If you choose a named range instead, you must specify the name of the range before naming the file in which it is stored. When the range is imported, the named range's assignment from the previous file is not imported along with it, but the range assignments of the current worksheet remain unchanged.

**X-Y-Z:CONSOLIDATE** Another alternative available to you is using the *X-Y-Z:Consolidate* utility. This handy program can summarize entire spreadsheets easily or slice through multiple worksheets and consolidate either rows or columns. *X-Y-Z:Consolidate* is menu driven and easy to use. It does not work on top of *1-2-3* but alongside of it, creating entirely new worksheet files in the same directory as the feeder files. *X-Y-Z:Consolidate* creates an audit trail file along with each consolidation. Two versions of the utility are available: one can consolidate up to 12 worksheets at a pass, and the other can handle up to as many as 255 files at a time.

**HAL** At the time of this writing, Lotus has not officially released *HAL*. But *PC Magazine* has seen a beta version, and we believe that *HAL* will be Lotus's answer to most of *1-2-3*'s shortcomings, including two-dimensionality.

*HAL* is a RAM-resident utility that works only with *1-2-3*. One of its features is the ability to link separate worksheets. For instance, if you are working on an expense consolidation worksheet and you change the numbers in the source worksheet, *HAL* updates the consolidated worksheet that it feeds to reflect the new numbers. A transcript file of the session, created in DOS, shows all the requests made with *HAL* and the commands used by *1-2-3*; it also serves as an audit trail.

*1-2-3* will remain two-dimensional, it seems. Lotus has made no changes toward multidimensionality in the latest upgrade, Release 2.01. But *HAL* brings you awfully close to that third dimension.—**Christopher Barr**

*Christopher Barr is a frequent contributor to* PC Magazine.

## PC MAGAZINE FACT FILE

***X-Y-Z:Consolidate***
Intex Solutions Inc.
568 Washington St.
Wellesley, MA 02181
(617) 431-1063
**List Price:** For up to 12 worksheets at a time, $145; for up to 255 worksheets at a time, $395.
**Requires:** 256K RAM, two disk drives or a hard disk, DOS 2.0 or later.
**In Short:** A utility that consolidates whole or partial *1-2-3* or *Symphony* worksheets. Not copy protected.
CIRCLE 640 ON READER SERVICE CARD

***HAL***
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
**List Price:** $150
**Requires:** 512K RAM, one disk drive, *1-2-3* (Release 1A, 2, or 2.01), DOS 2.0 or later.
**In Short:** A RAM-resident utility that works only with *1-2-3* and uses easy-to-understand English-language commands. Not copy protected.
CIRCLE 639 ON READER SERVICE CARD

# PROBLEM: The more experience your hard disk has, the harder it has to work.

# THE SOFTLOGIC SOLUTION: Disk Optimizer™

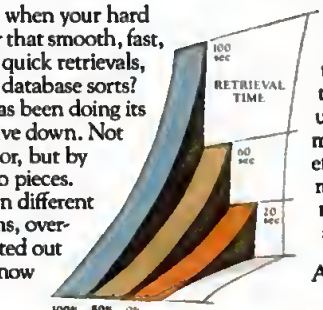
**Your hard disk will run faster when it's not chasing around after files.**

Remember the old days when your hard drive was new? Remember that smooth, fast, slick performance? Those quick retrievals, rapid saves, lightning-like database sorts?

Well ever since, DOS has been doing its best to slow your hard drive down. Not by slowing down the motor, but by breaking your files up into pieces. Storing different chunks in different places. Data files, programs, overlays and batches that started out in one seamless piece are now scattered all over.

Loading is slower. Sorting is slower. Retrieving, backing-up. Everything takes longer because your disk has to work harder.

Problem is, it's something that happens so gradually you may not notice the difference. At least, not until you see the dramatic improvement after using Disk Optimizer.




**File fragmentation—It's a problem you can see.**

Watch your hard drive the next time it reads or writes a file. Each "blip" of the LED means the drive-head is moving to another place on the disk—either to pick up or lay down another chunk of data.

And the truth is, head movement takes time. Far more time than actual reading and writing. What's worse, all this head movement causes extra wear and tear that can shorten the life of your drive.

**Disk Optimizer—Tunes up your disk by cleaning up your files.**

Disk Optimizer works by finding all the scattered pieces of your files and putting them back together where they belong. Next time your drive reads it, there's just one place to look.

And the results are often dramatic. Reading and writing times may be cut by as much as two thirds. Database sorts that used to take hundreds of head moves now proceed quickly and efficiently. And since head movement is now at an absolute minimum, your disk drive will lead a longer, more productive life.

**Analyze, scrutinize, optimize.**

Before you optimize, you'll probably want to analyze. So Disk Optimizer shows you, in percentages, how much fragmentation has taken place—on the entire disk, in individual directories, or for groups of files you specify using global or wildcard names.

Plus, there's built-in data security that lets you assign passwords to as many files or file groups as you want.

And the File Peeker gives you an inside look at the structure of files. It's a great way for non-programmers to learn more about computers, and a powerful tool for professionals who want to analyze the contents of their disks.

**Get your hard drive back in shape—at a special low price.**

When you think about it, it's simple. The longer you own your hard drive, the more you come to depend on it. But the longer you wait to get Disk Optimizer, the less performance you'll have.

**Special holiday offer—free* SoftLogic software.**

Now, as a special holiday bonus, you can get another SoftLogic Solutions product free when you buy Disk Optimizer and Software Carousel—the software that lets you keep up to ten programs loaded and ready to run.

Take your choice of either Cubit or DoubleDOS.

See the coupon below for details. But don't wait. This offer expires December 31, 1986. SoftLogic Solutions products are available at your software dealer. Or by calling SoftLogic Solutions at 800-272-9900 (603-627-9900 in New Hampshire).

## Free Holiday Offer!

Buy Disk Optimizer and Software Carousel and get your choice of either Cubit—the software that packs more data onto less disk space—or DoubleDOS—the software that lets you and your computer work on two different tasks at once.

Enclose proof of purchase for Software Carousel and Disk Optimizer, both registration cards, this coupon, and $5.00 (check or money order) for shipping and handling (UPS). Offer expires Dec. 31, 1986. Allow up to four weeks for delivery.

YES! Please send my free copy of ☐ DoubleDOS ☐ Cubit (check one)

Name _____

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SoftLogic Solutions, Inc.
530 Chestnut Street
Manchester, NH 03101
(800) 272-9900
(603-627-9900 in NH)

SOFTLOGIC SOLUTIONS

Disk Optimizer $49.95*

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*plus $5.00 shipping and handling.

CIRCLE 334 ON READER SERVICE CARD

bles, and Dimensions as choices corresponding to the F1, F2, and F3 keys, respectively.

To create a file, you must first establish dimensions. The dimension form contains only three columns and may include numeric, calculated, or string elements. The first column specifies the data type, the second column contains its label, and the third column holds any specified weight for the component. No data is stored here.

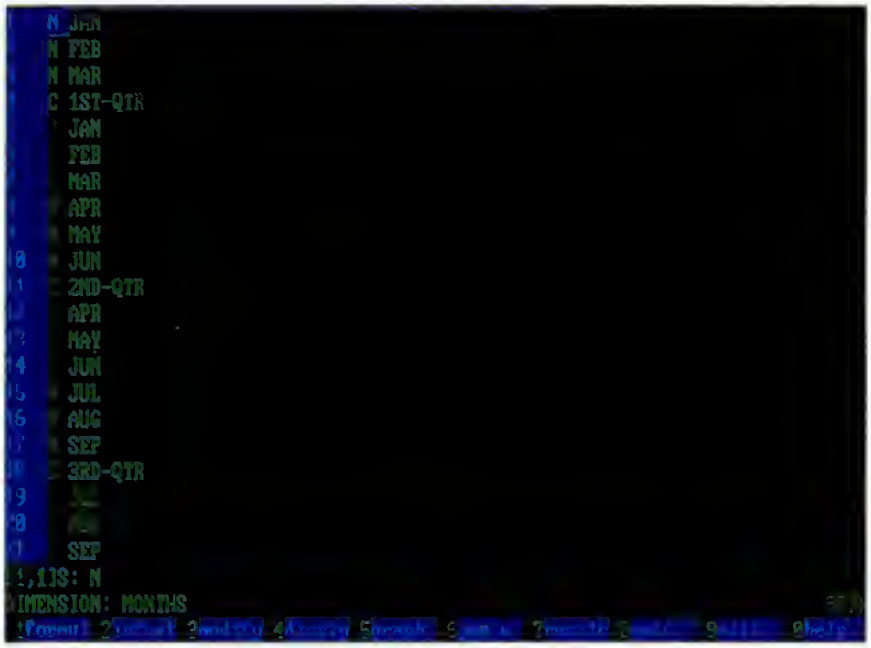
The tables in which you store data are

■ *TM/1* can bring in relational data from mainframes, store it in multidimensional tables up to 32 megabytes in size, and let you cross-tabulate any subset.

defined in terms of dimensions, and you create them by specifying the dimensions that label their data. Each table can contain up to eight dimensions. The process is very easy: you select the dimensions to be included from a menu of those already created, then press the F1 key to view data. You'll see a data entry form that's been set up automatically and that initially includes only your established dimension labels and rows and columns full of zeros. Enter your data, and you're ready to tackle a worksheet.

Any worksheet can access as many as 60 dimensions and 60 tables simultaneously, analyze the data with formulas you enter into appropriate cells, and display the results. You create the formulas through a semi-automatic method of selecting components from menus. By changing retrieval labels on the worksheet, you can look at any "slice" of data you wish.

The tabular concept has several advantages. You can apply many types of analysis separately to the same central core of data. When numbers are updated in the




*A typical* TM/1 *"months" dimension. This format calculates quarterly totals for whatever figures you apply to the dimension.* TM/1 *stores data in tables, but you can use this worksheet format as a display area.*

tabular database, every model that addresses it is updated, too. If subtotals and totals are defined along each dimension, you not only obtain the expected totals for each page, but also get automatic consolidation across pages at the same time. User-defined names are attached to data instead of cell addresses, and you can retrieve any data from any file by name.

Since the data is not stored in the worksheet, you could use the same worksheet to analyze every department of your company. To change from one department to another, you could simply type in the new department name and press the F7 key to recalculate. The tabular data for the new department will be instantly loaded and analyzed according to the formulas you've established.

*TM/1* can bring in relational data from mainframes, store it in multidimensional tables up to 32 megabytes in size, and let you cross-tabulate any subset. You can import data from micros in ASCII, DIF, *1-2-3* or *dBASE* formats.

The program requires at least 256K RAM and will use all the memory available to speed up processing, but even when used on a computer equipped with the minimum, *TM/1*'s virtual memory architecture will enable it to handle your largest files. Although Sinper Corp. recommends using a hard disk, *TM/1* will run from one floppy disk drive. The 8087 math chip is supported if found, and calculations are accurate to 15 digits.

To produce a Report, you simply design your worksheet in the format you want for the report and then go ahead and print it. You can also produce attractive graphs on the screen and print them by just pressing Shift-PrtSc. The types of graphs available include bar, stacked bar, line charts, and *x-y* curves.

*TM/1* has a macro language powerful enough to produce turnkey applications, and a learn mode for recording keystrokes

PC MAGAZINE FACT FILE

TM/1

***TM/1*, Release 2.0**
Sinper Corp.
8901 Tonnelle Ave.
North Bergen, NJ 07047
(201) 662-7999
**List Price:** $795
**Requires:** 256K RAM, one disk drive, DOS 2.0 or later.
**In Short:** This spreadsheet, with 60 dimensions, is an advanced program of unusual power. Not copy protected.

CIRCLE 642 ON READER SERVICE CARD

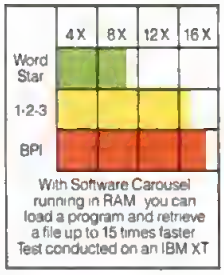
# PROBLEM: There's just no easy way to move from one software program to another.

# THE SOFTLOGIC SOLUTION: Software Carousel

**Now you can keep up to 10 programs loaded and ready to run.**

Hard to believe, but some people are happy with just one kind of PC software. Well, this is not a product for them.

But if you're someone who depends on many packages, all the time—someone who'd use several programs at once if you could, well now you can. With Software Carousel.



With Software Carousel running in RAM you can load a program and retrieve a file up to 15 times faster. Test conducted on an IBM XT

**Why call it "Software Carousel"?**

In some ways, Software Carousel works like the slide projector you're used to. You load a handful of pictures, view one at a time, then quickly switch to another. A simple idea, with powerful possibilities for computing.

Here's how it works. When you start Software Carousel, just tell it how much memory you have, load your software and go to work.

Need to crunch numbers? Switch to your spreadsheet. Need your word processor? Don't bother saving your spreadsheet file. Just whip over to your document and do your work. Snap back to your spreadsheet, and it's just like you left it.

With up to ten different programs at your fingertips, you'll have instant access to your database, communications, spelling checker, spreadsheet, word processor, RAM resident utilities, languages, anything you like.

**Reach deep into expanded memory.**

This could be the best reason ever for owning an expanded memory card, like the Intel Above Board, AST RAMpage, or any card compatible with the L/I/M Extended Memory Standard.

Software Carousel puts programs into this "high-end" memory for temporary storage when they're not in use. And switches them back out when you want them. It's fast, efficient, and easy.

If you want, Software Carousel will even use your hard drive for swapping. Just allocate a portion for storage, and go to work.

**Sidekick, Superkey and Ready. All at the same time.**

You know what happens if you try loading two or more RAM resident utilities at once. You get crashed keyboards, frozen screens, all kinds of interference between programs fighting for control.

With Software Carousel, you can have as many accessories and utilities on-tap as you want. Just load different ones in different Carousel partitions. Since they can't see each other, they can't fight.

**The easy way to maximize PC power.**

With all this power, you might think Software Carousel is complicated and difficult to use. Not so. Set it up once, and it will remember forever. Better still, Carousel will look for the programs you use most often, and optimize them for the quickest access.

**Special holiday offer—free* SoftLogic software.**

As a special holiday bonus, you can get another SoftLogic Solutions product free when you buy Software Carousel and Disk Optimizer—the software that speeds up your disk by cleaning up your files.

Take your choice of either Cubit or DoubleDOS.

See the coupon below for details. But don't wait. This offer expires December 31, 1986. SoftLogic Solutions products are available at your software dealer. Or by calling SoftLogic Solutions at 800-272-9900 (603-627-9900 in NH).

## Free Holiday Offer!

Buy Software Carousel and Disk Optimizer and get your choice of either Cubit—the software that packs more data onto less disk space—or DoubleDOS—the software that lets you and your computer work on two different tasks at once.

Enclose proof of purchase for Software Carousel and Disk Optimizer, both registration cards, this coupon, and $5.00 (check or money order) for shipping and handling (UPS). Offer expires Dec. 31, 1986. Allow up to four weeks for delivery.

YES! Please send my free copy of ☐ DoubleDOS ☐ Cubit (check one)

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SoftLogic Solutions, Inc.
530 Chestnut Street
Manchester, NH 03101
(800) 272-9900
(603-627-9900 in NH)

SOFTLOGIC SOLUTIONS

Software Carousel $49.95*

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*plus $5.00 shipping and handling.

CIRCLE 336 ON READER SERVICE CARD

automatically. Functions include the standard mathematical, trigonometric, financial, and basic statistical algorithms and a variety of string, date, and time functions.

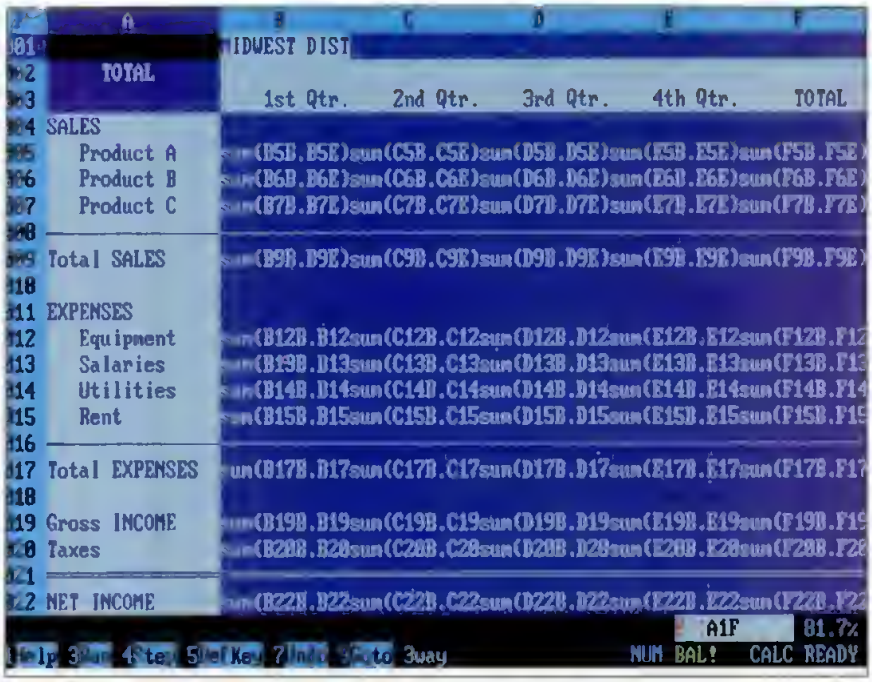
A demo disk supplemented by tutorial material in the excellent manual gets you up and running in this 60-dimensional universe. Telephone help is free.

*TM/1*'s retail price is $795. Its concept is light-years ahead of the competition.

## microCUBE

McDonnell Douglas Communications' *microCUBE*, Version 1.3, shares many features with *CalcIT*, but it costs 3 times as much. It gives you telecommunications and graphics modules besides the three-dimensional spreadsheet, which partly explains the cost differential.

You also get the latest technology from Datamension, an Illinois firm with 16 years of experience in supplying private-label three-dimensional spreadsheets to industry. Datamension developed the *CalcIT* spreadsheet several years ago to Martin Marietta's specifications, and more recently it built the *microCUBE* spreadsheet for McDonnell Douglas. (The telecommunications and graphics modules were written by McDonnell Douglas.) Although *CalcIT* calls its spreadsheet a DataCube, and *microCUBE* terms its spreadsheet a Spreadspace, the programs share a cell-labeling system, use similar menus and the EXEC macro language, and have much more in commmon.




microCUBE, *essentially an updated and enhanced version of* CalcIT, *includes some unique features that no other spreadsheet can match. This* microCUBE *screen shows formulas that cut across dimensions to create a summary page.*

*microCUBE* also includes a number of improvements, some of which are features that *CalcIT* clearly lacks. For example, *microCUBE* supports the 8087 coprocessor and offers numerical precision to 16 significant digits. But some of its feature are exciting innovations not available in any other spreadsheet.

One valuable *microCUBE* feature that competitors are likely to copy soon is Visual Audit, an audit trail using color codes. When you enter or change a figure in a cell, all other cells affected by the change are highlighted in a different color.

If you find that you've entered an incorrect label, number, or equation, you can press the F7 key (the "undo" key) to restore the spreadsheet to the state it was in before you made the mistake.

Goal-seeking is a powerful *microCUBE* exclusive. You can change a result figure, and the program will change supporting numbers to show what they would have to be to produce the result you want. In using this feature, you can lock cells containing fixed costs; those cells will not be changed on the worksheet.

You can name cells and do string math. The program will also let you place two formulas in the same cell, so you can cross-foot a row and a column. If the horizontal and vertical formulas don't agree, you'll get an error message.

*microCUBE* will produce up to four graphs on a screen. Since data is stored separately from the graph model you construct, you can easily use the same model later with a different set of figures or the same figures with a different graph.

The communications module facilitates the exchange of information with other micros or with mainframes, including VAX, UNIX, and IBM VM/CMS systems. You can transmit all or part of a file through a variety of modems. If you select file transfer with error-checking protocol, the remote computer must have the *microCUBE* protocol software installed. You can preset file transfers from a menu to begin at a specific time; *microCUBE* will generate automatic session logs.

Besides importing and exporting DIF and ASCII files, *microCUBE* supports NIF (named interchange format). NIF allows you to transfer data between your PC and the McDonnell Douglas RMS Mainframe System or any foreign mainframe

PC MAGAZINE FACT FILE

*microCUBE*, Version 1.3
McDonnell Douglas Communications
7535 E. Hampden Ave., #200
Denver, CO 80231
(303) 695-1500

**List Price:** $1,200
**Requires:** 512K RAM (640K recommended), hard disk, DOS 2.0 or later. Modem required for using communications module.
**In Short:** An excellent 3-D spreadsheet with exciting new features and a high price to match. Includes telecommunications and graphics modules. Not copy protected.

CIRCLE 641 ON READER SERVICE CARD

# PROBLEM: Handling your need for more megabytes, without spending megabucks on a new drive.

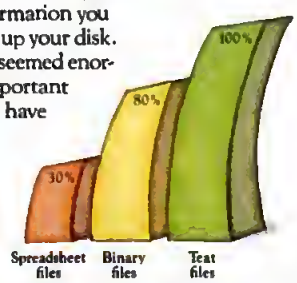
# THE SOFTLOGIC SOLUTION: Cubit™

**Now get up to twice the capacity from all your storage media.**

You know what happens. The more you use your computer, the more information you create. And the faster you fill up your disk.

The 10MB drive that once seemed enormous is now jammed with important files. That 20MB that should have lasted years is crowded in a matter of months.

Of course you could keep buying bigger hard drives. Or you could get Cubit and get the maximum storage space from the drives you already have.




With Cubit, you'll get as much as 100% compression on data files, effectively doubling the storage capacity of all your magnetic media.

**What is Cubit?**

In brief, Cubit is an advanced software tool that automatically reduces the number of bytes required to store a file, then converts the file back to its original size when retrieved. Some programmers call this effect "data compression," others, "disk expansion." Either way, the result is the same.

Here's how it works. When Cubit compresses a file, it first compares each word to its massive English word dictionary. Words that match are reduced to a predetermined code of just one, two or three bytes each. It then saves the abbreviated version to disk. Decompression works just the opposite.

To accommodate other words and symbols, Cubit uses two more compression techniques. One assigns new, shorter codes to unusual words. Another compresses according to the frequency of character strings in non-text data. So no matter what kind of files you create, Cubit ensures maximum space savings.

Best of all, you'll be using the same fast, reliable data compression techniques used on mainframe computers for decades.

**How much disk space will you save?**

Because the vast majority of data created on PC's is standard ASCII text—letters, numbers and other English language symbols—we've optimized Cubit for word processing and database files. With these, you'll get a minimum of 50% expansion on up to a full 100% or more.

At the same time, you can expect a significant 30% to 50% improvement with other kinds of data. Including spreadsheet files, program code, graph and image files, even binary data.

And Cubit works just as well with floppies and tape cassettes as it does with hard disk drives.

**Run Cubit where you want, when you want.**

Maybe you'll want to use Cubit for all your files, or maybe just some. So Cubit lets you specify exactly which files to work on and which ones to leave alone.

In RAM resident mode, Cubit works quickly and invisibly, compressing and decompressing right from within any program you run. Or use Cubit's powerful file management mode. It supports wild-card and global file names, and addresses sub-directories up to thirty levels deep.

**Save time and money, as well as disk space.**

A compressed file is a smaller file. So with Cubit, back-ups take less time, as well as less space. And communicating compressed files means significant savings on phone line charges.

Any way you look at it, Cubit will pay for itself in no time. And that's especially true now.

**Special limited time offer.**

Buy Cubit now and you'll save even more. Because for a limited time, you can buy Cubit at the special introductory price of just $49.95.* But hurry. This special price won't last long.

Ask for Cubit at your computer dealer. Or order directly from SoftLogic Solutions by calling 800-272-9900 (603-627-9900 in NH), or mail in the coupon below.

Special pricing is available when you buy Cubit along with other SoftLogic products including DoubleDOS, Software Carousel and Disk Optimizer. Ask for details.

## Cubit™ $49.95*

YES! Please send me____copies of Cubit at this special introductory price.

Name_____

Company_____

Address_____

City_____State/Zip_____

Check Enclosed ☐ VISA ☐ MC ☐ AMEX ☐

Card # Exp. Date

Signature_____

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CIRCLE 288 ON READER SERVICE CARD

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CIRCLE 347 ON READER SERVICE CARD

Only ONE TOOL DOES IT ALL!

VERSION 4.0

**RECOVER**

UNFORMAT YES!
UNDELETE
REMEDY
RECLAIM

**OPTIMIZE**

UNFRAGMENT
VCACHE
SORT/SQUEEZE

**$99.00**
Suggested Retail

**ORDER TOLL FREE CALL (800) 523-0258**
For Technical Assistance (503) 488-0224

Paul Mace SOFTWARE

*Paul Mace Software Inc., 123 N. First St., Ashland, OR 97520*

CIRCLE 193 ON READER SERVICE CARD



system by establishing label vectors.

*microCUBE* is so laden with features that its three-volume documentation runs to 1,200 pages. Each section in the manuals includes tutorials. The major disadvantage of the three manuals is that their indexes are far from complete. For instance, you'll look in vain for the word *copy* and eventually find that the program uses a command called Replicate. Free technical support is available through a toll-free telephone number.

Installing *microCUBE* can present problems, especially if you're installing it on any hard disk other than the C: drive. Copy protection was removed recently, but the installation batch files are still complex. The toll-free support line will come in handy during installation.

Unlike *CalcIT*, *microCUBE* requires a hard disk, and it occupies 2 full megabytes of that disk. You'll also need a minimum of 512K bytes of RAM, as compared to *CalcIT*'s 128K-byte RAM requirement.

If your budget can withstand the fee, *microCUBE*'s unique features are sure to please you. PC

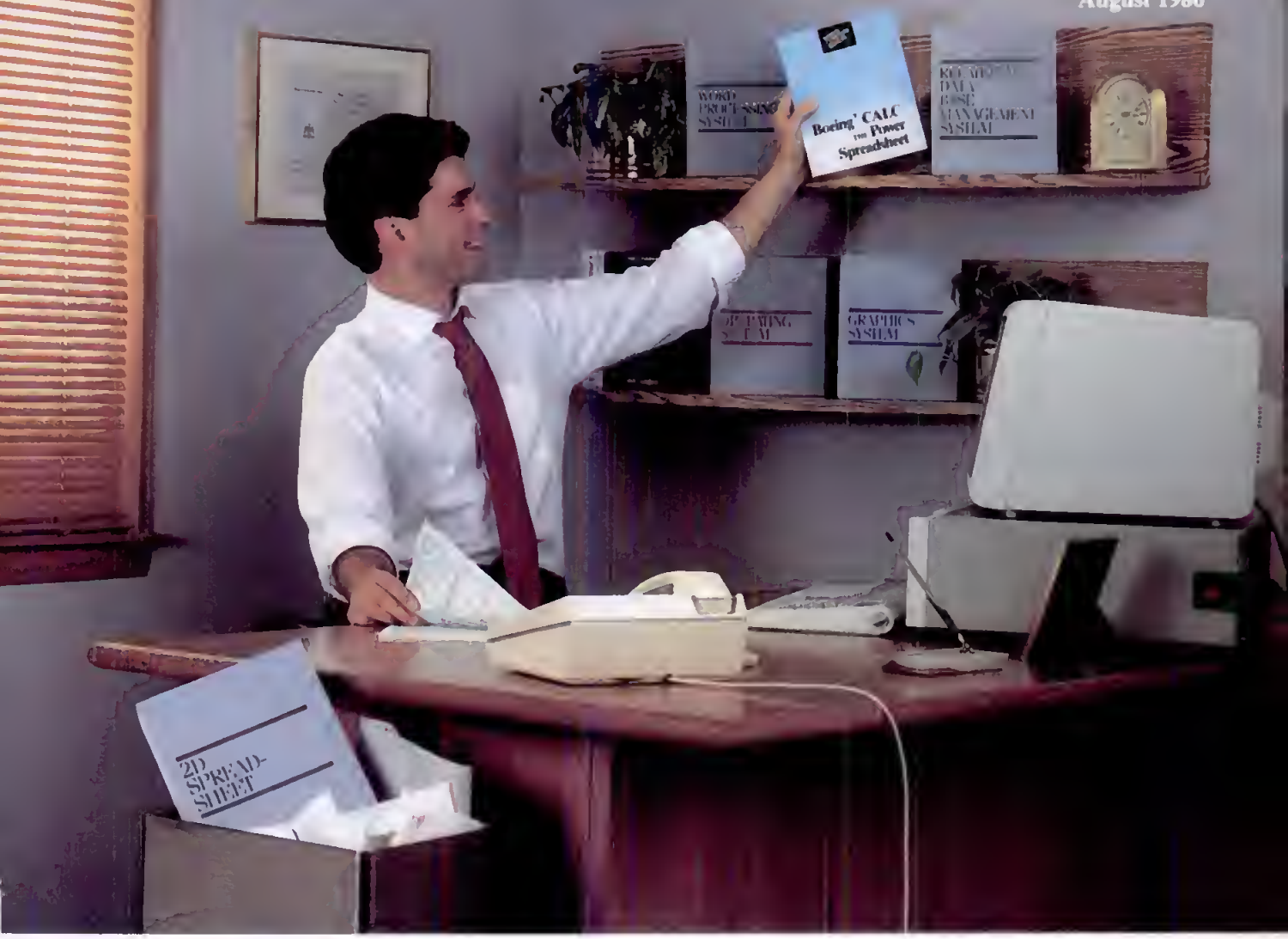
PC MAGAZINE EDITOR'S CHOICE

***For the best combination of price, features, ease of use, and import/export capabilities, Boeing CALC comes out on top. Both its similarity to 1-2-3 and its ability to import functioning 1-2-3 and Symphony worksheets make it a practical buy. However, if you want the ultimate in multidimensional technology, TM/1 can give you the mind-blowing power of 60 dimensions. microCUBE has a stiff price tag but adds great new features to a more conventional structure.***

*Marvin Bryan is vice president of strategic planning and research for one of the nation's leading advertising agencies and supervises microcomputer operation in his department. He has written many articles on computing and is a member of the American Statistical Association.*

# "With Boeing's new entry, the 3-D spreadsheet comes of age."

PC Magazine
August 1986




**Boeing CALC makes the 2-D spreadsheet obsolete**

"This thing is hot . . . fast . . . I used it effortlessly." That's what PC Magazine says about Boeing® CALC —the 3-D spreadsheet so powerful it makes memory expansion boards overpriced and obsolete.

Like a giant ledger book, Boeing CALC's 32 MB file capacity lets you consolidate spreadsheet information from any department or location into a single file . . . with up to 16,000 *rows*, 16,000 co*lumns*, and 16,000 *pages*. Enough power and speed for even the most sophisticated finance and planning needs.

You can do arithmetic and command execution between pages as easily as you would on one. That means no more complex multi-page consolidations and cross-file analysis. And no more grueling hours reconstructing equations and relationships when you add or delete pages. Boeing CALC reassigns them automatically.

**Designed to work with other spreadsheets**

Boeing CALC uses a command structure familiar to Lotus 1-2-3® users. And it reads and writes 1-2-3 and Symphony® binary files directly. You can consolidate spreadsheets quickly and simply. With no rekeying. And no retraining. If you need to share information, use Boeing CALC for LANs. Share files, share the work—with cell-level security for data integrity.

**Give your spreadsheet users real power . . . with Boeing CALC**

It's inexpensive. And it's available locally. For the name of the authorized dealer nearest you, call TOLL-FREE 1-800-551-0800, ext. 12. Direct international calls to 206-865-5000, ext. 12. Or write BOEING COMPUTER SERVICES, P.O. Box 24346, M/S 7W-05, Seattle, WA 98124-0346. CIRCLE 129 ON READER SERVICE CARD

***Another quality software product from Boeing.***

BOEING

Boeing is a registered trademark of The Boeing Company.
Lotus, 1-2-3, and Symphony are registered trademarks of Lotus Development Corporation.

*First new ¼ inch cartridge since 1971*

# Cartrex introduces the first, brand-new, ¼-inch tape cartridge technology in over 15 years for some fundamental technical reasons. . .

**. . .and today's tape drive need for 400% increase in tape speed, 500% increase in track density, 1000% increase in bit densities, and 3000% increase in bits/second, are just a few. Read on to get the complete story.**

### Why a new cartridge

With the significant increases in tape drive capacity, system reliability demands a tighter tolerance cartridge. Most tape drive users aren't aware that all of the tensioning, tolerance, and data reliability issues are virtually all a function of the tape cartridge.

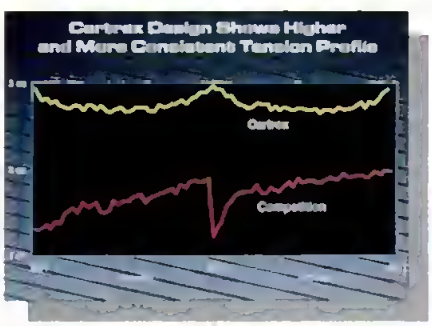
When 3M announced its cartridge in 1971, it was designed for a low capacity tape drive with less than 3 megabytes—2.88 to be exact. The tape was low in density—1600 bits per inch with only 4 tracks and 300 feet of tape.

The tolerances required for the tape drives of the early 1970's were fine for then, but today's tape drives require much tighter tolerance. Today's tape cartridges must work with drives that have 9 or more tracks and bit densities as high as 12,000 bits per inch on 600 feet of tape. That means capacity increases of 2,000 percent packed into the same cartridge.

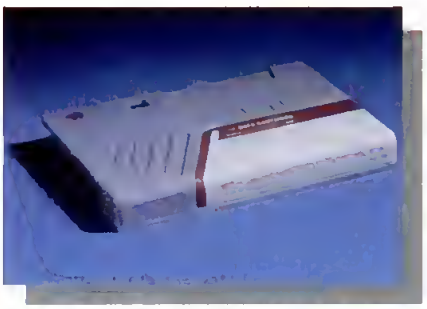
The reasons that yesterday's cartridge technology simply won't work properly in today's high capacity drives is inherent in the cartridge design. The three culprits that make cartridge tolerances so important are fluctuating tape tension, redeposit nodules, and instantaneous speed variations (or ISV).

### Tape Tension

Tape tension at the read-write head is important because the tape drive's electronics expect data to arrive at a constant rate. Consistent tape tension is a function of the cartridge tensioning mechanism. The new Cartrex cartridge tensioning design, based on a mechanical differential between two stiff belts, provides very predictable results. The historic 3M design—used by 3M and DEI—uses an elastic belt coupled with drag friction at the rear pulley to create tension. The accompanying graph shows the significant improvement the Cartrex cartridge design offers over the conventional design.




*The Cartrex cartridge provides predictable and stable tension. Compare it to the tension variation of the conventional cartridge design. The consistent Cartrex tension virtually eliminates data errors and data loss from head-to-tape separation and redeposit nodules that can occur with fluctuating, low-to-high tension performance.*



*The new Cartrex ¼-inch tape cartridge is the first new tape cartridge design in almost a decade and a half. Tape drive manufacturers now have a new cartridge technology which allows them to advance today's and tomorrow's drive performance.*

### Redeposit Nodules

Redeposit nodules are the insidious flakes of tape media that break off from the edges of the tape and get dragged to the edge of the read-write head. If the tension is low, or becomes low when the tape starts or reverses, the flakes slide past the edge, get smeared across the head, and reduce its ability to read data.

The free play in the two tape reels combined with the tape guides are the primary culprits in creating these redeposit nodules. As the tape enters the guide from the tape pack, the tape guide aligns the tape by balancing the tension at the edges of the tape. Uneven edge tension not only causes media to flake off causing redeposit nodules, but data is lost due to the "coining" or "scalloping" effect.

Cartrex eliminated the cause of the tape coining or scalloping with a barrel-shaped roller placed in front of the tape guide. The roller positions the tape and drops the edge tension to zero. By using this roller, the possibility of media flaking off and creating redeposit nodules is virtually eliminated.

### Instantaneous Speed Variation (ISV)

Instantaneous speed variation is exactly what it sounds like—small, instantaneous changes in tape speed as it crosses the tape head. At slow tape speeds and low bit densities—like the 1971 standard of 30 inches per second and 1,600 bits per inch—ISV wasn't as big a problem. At that time, the bits were crossing the head at 48,000 bits per second.

Today, however, the story has changed. Ninety inches per second and 8,000 bits per inch mean that 720,000 bits cross the head every second. A 1,500% increase. As you may have guessed, 1971 speed fluctuations in the 48,000 bits per second range made reading data difficult for tape drive electronics. But today, when the electronics have to guess whether or not the bit rate of 720,000 bits per second is accurate, the electronics can become overwhelmed.

The Cartrex tensioning mechanism relieves the overload placed on the electronics with respect to ISV. The longitudinally stiff belts ensure tension at all times. The stiff belt overpowers variations that exist with the 3M elastic belt cartridges. The barrel roller guides, in addition to reducing the edge pressure to zero, tend to dampen out any residual ISV effects.

*High speed tape seldom enters tape guides parallel to the top and bottom, even with improvements to the tape reel hub designs. The edge pressures which result create "scalloping" or "coining" on the tape. The effect is data loss due to head-to-tape separation, flaking media that smears across the head, and "redeposit nodules" that create hard errors.*

### Never a Single Issue

Your tape drive seldom has the luxury of dealing with an isolated problem. It's usually a combination of ISV, redeposit nodules, and tension problems all together. Now you understand why Cartrex developed a modern cartridge alternative.

### Where to get it

Not only has Cartrex improved on the industry's 15 year old technology, they have done it for a competitive price.

Now you can have peace of mind when you back up your hard disk on today's sophisticated tape drives.

And you can have it fast. Simply phone and give Cartrex your purchase order number or your credit card number and they will send your cartridges by return mail.

**(619) 485-6603 Ext. 2000**

Dealer Inquiries Invited.

CARTREX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MARKETING HEADQUARTERS
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SAN DIEGO CALIFORNIA 92127
619-485-6603
TELEX 7101115609
FAX 619-451-3640


The first real alternative in ¼-inch tape cartridges™

CIRCLE 325 ON READER SERVICE CARD

# MSR: A New Approach to Software Support

*Good help is hard to find—especially technical help. Hot-line support, direct from a hardware or software manufacturer, sometimes leaves you out in the cold. Micro Support Resource's AnswerLine offers a fast, reliable alternative.*

Obtaining good product support can be one of the most time-consuming, frustrating, and exhausting experiences. Unless you have access to knowledgeable friends or colleagues, the obvious place to go for help with technical problems is usually either your dealer or the product manufacturer. But as the numbers of products and users multiply, dealers and manufacturers are finding it difficult to maintain a reputation as purveyors of technological wisdom and to keep up with demand.

"It's gotten to the point where the overhead costs associated with delivering help far outweigh the revenues," says David Tranberg, vice president for sales and marketing for Micro Support Resource Corp. (MSR) of Atlanta. "You must rely on continued new revenues to provide the old customers with their base of support. And software companies can't afford to do that. For example, *WordPerfect* has 70 support analysts who just answer questions. If the company is paying an analyst $30,000 a year, that's $2.1 million a year just to provide support; on revenues totaling $20 million, that's 10 percent of operating costs."

MSR is a new factor in this user-support equation: an independent service organization that provides over-the-phone help for both hardware and software. The company was founded in March 1985 by five former employees of Samna Corp. who decided that there was a place in the now-mature microcomputer marketplace for a different type of company.

**A NOT-SO-NEW IDEA** "The concept is really old," says MSR president Deborah Fain. But she and her colleagues waited until the timing was right. "About a year and a half ago, the industry took a dive. Manufacturers couldn't give help away anymore, and the idea began to seem realistic."

MSR, which also holds classes for companies in the Atlanta area, began delivering AnswerLine telephone product support in November 1985. The idea behind the service is simple: for an annual fee of $100 to $150 per product, subscribers can make 20 toll-free calls for help with one of the 7 products that MSR currently supports, including *1-2-3*, *Symphony*, *dBASE III* and *III Plus*, *WordStar* and *WordStar 2000*, *Crosstalk*, *Microsoft Word*, and, of course, *Samna Word III*.

Rather than rely on in-house experts for user support, MSR created its own menu-

based database system called MAX (short for magic answer extractor), which runs on an IBM System/36 minicomputer. According to MSR's Tranberg, the system helps MSR avoid a basic problem that many software companies face. "What happens when a particular expert leaves? We offer accurate, consistent answers. Once we solve a problem, if it isn't in MAX we add it to the database, and that information is accessible to all our support analysts."

Each subscriber to AnswerLine is issued an access number that is also tied to a password chosen by the subscriber. Once a call is initiated, MAX takes operators through a branching series of questions about the problem, eventually working its way down to several specific queries that should lead to a solution.

According to Charlotte Hixon, director of support for MSR, the queries stored in MAX are written to take into consideration the manner in which most users phrase their problems. "For example, the first product I worked on was *1-2-3*. I wrote the question: 'I copied or moved a range of cells, and now my formulas don't work.' Then I realized that if I really got into a mess, I wouldn't remember that I copied or moved, I'd just know that my formulas didn't work. The structure of MAX came out of realizations like that."

PC MAGAZINE FACT FILE

**AnswerLine**
Micro Support Resource Corp.
3355 Northeast Expwy., #150
Atlanta, GA 30341
(800) 235-9740
(404) 452-7676
**List Prices**: Support for *1-2-3*, *Samna Word III*, *DisplayWrite 3*, *MultiMate/Advantage*, *WordStar*, *WordStar 2000*, *Crosstalk*, *WordPerfect*, *Microsoft Word*, *SideKick*, and *FormsManager*, $100 per product per year, up to 20 calls; *Symphony*, *dBase III*, *Enable*, *Paradox*, and *R.base 5000*, $125 per product per year, up to 20 calls; *dBASE III Plus*, $150 per year, up to 20 calls; any three or more products, $300 per year, up to 60 calls.
**In Short:** An annual fee entitles the MSR subscriber to over-the-phone assistance from a trained technical-support staff.
CIRCLE 888 ON READER SERVICE CARD

If the operators can't answer a question immediately through MAX, they take the caller's phone number, and MSR personnel research the question. "The average call runs between 6 and 7 minutes," Hixon reports. "Right now, 66.6 to 70 percent of problems are resolved as they call in. The 30 percent of calls that do go into research can usually be resolved in less than an hour."

**CALLING FOR HELP** I tested MSR's service by calling with questions concerning three of the major software packages it supports: MicroPro International Corp.'s *WordStar*, Ashton-Tate's *dBASE III*, and Lotus Development Corp.'s *1-2-3*.

PC Labs wrote three questions for each package, covering a variety of problems software users are likely to encounter. The questions ranged from comparatively simple inquiries typical of novices to more-complex and subtle problems that could stump an expert. Also included were a few red herrings, that is, questions that involved actual bugs in the software or had no real solution.

Since MSR is marketing its services as an alternative to dealer support, PC Labs compared them with the services offered by the software manufacturers. Lotus still gives free help to anybody who calls with questions on its popular spreadsheet program, *1-2-3*. Ashton-Tate controls its *dBASE* help line by insisting that callers be officially registered with the company and have their serial numbers ready. MicroPro offers *WordStar* users a choice: a free help line or its new Premium Service Plan, which is a subscriber service that offers extended help for an annual fee of $95 (or $60 for 6 months).

It is the lucky PC user who hasn't spent an afternoon redialing a consistently busy support line and/or waiting on hold. According to Hixon, MSR avoids those pitfalls by running an automatic call distribution system that monitors all incoming calls, including follow-ups on previous problems, and ensures that they are answered within 45 seconds.

In this area, at least, MSR lives up to its promise. Every time I dialed the AnswerLine's toll-free number, I was immediately connected to a recording informing me that I had reached the AnswerLine and asking me to hold on. I was usually connected to a technician within 30 seconds or less; the longest I had to wait was 2½ minutes.

None of the manufacturers' support lines was quite as easily accessible. Lotus's operators quickly answered my calls, and although they warned me several times that I might have to hold for as long as 5 to 10 minutes, I was usually in contact with a technician within only 3 minutes. Ashton-Tate's service was a bit harder to reach. My first attempts to call were unsuccessful, yielding four busy signals in a row and, on the fifth try, a request that I try again in half an hour. This was unusual, however; afterward, I was on hold for 5 minutes at most.

MicroPro's Premium Service Plan varied in its responses. The first time I called, the operator took my account number, name, and phone number and told me I'd be called back. It took them 38 minutes to return my call. At other times I was immediately connected with a technician. As for MicroPro's free support department, I never got past the busy signal.

**ORAL EXAMS** Two of the three questions about *1-2-3* concerned the use of the spreadsheet program itself, rather than any innate bugs or eccentricities. In both cases, MSR and Lotus solved the problem in approximately the same amount of time (see sidebar "Testing MSR's Skills—and Yours").

The third problem was a tricky one, dealing with Version 1.1A's disconcerting tendency to "take over" a color screen: all programs you try to run afterward appear in monochrome mode. Although the MSR technician who answered my call did not initially recognize the problem, she took down the information and hung up to do a little research. Twenty-four minutes later, she called back and helped me create a batch file that solved the problem. Lotus's technician informed me that the problem was a "known occurrence" with Version 1.1A and that the only way around it was to reboot the system—not a satisfactory solution and certainly not what I expected from the manufacturer of the product.

On the other hand, when I posed a tricky question involving *dBASE III* to MSR, its lack of inside information led it

# TESTING MSR's SKILLS—AND YOURS

How savvy a software user are you? Try your skill at answering the questions we devised to measure the efficiency and the accuracy of MSR's service against the support provided by the software vendors themselves. You'll find the answers at the end of this article.

The times listed below show how long it took MSR and the vendors to answer the questions. All times are in minutes. "On Phone" refers to time spent on the phone, including holds. "Waiting" refers to time spent off the phone waiting for a return call.

—Barbara Krasnoll

## WORDSTAR

**1.** I'm trying to install *WordStar*, Version 3.30, and every time I run the WINSTALL.COM program, I'm told that I don't have enough memory—but I have 640K bytes of RAM.

**2.** I'm trying to print from *WordStar*, Version 3.30, to an Apple LaserWriter that's set up as a Diablo 630. I've reinstalled *WordStar* to recognize that printer, but the paging is misaligned, with the beginnings of new pages appearing on the ends of old ones.

**3.** I have a *WordStar* document that I typed single-spaced. I need it double-spaced, and so I put in a Double-space command and reformatted it, but there are still single spaces between paragraphs.

## 1-2-3

**1.** Every time I run *1-2-3*, the program goes over to drive A: to look for a directory. I've used the Worksheet-Global-Default-Director commands to change this, but it doesn't work when I run *1-2-3* again.

**2.** When I exit *1-2-3* and try any program that has color graphics, only black-and-white images appear on the screen. Everything returns to normal if I reboot. How can I get color without rebooting?

**3.** I'm trying to use *1-2-3* to create my expense report and am using a double-entry technique that verifies amounts billed to me against monies I've paid out. At the bottom of the sheet I use an If statement to do the actual comparison against the sum of the two sets of dollar amounts. Even though the two numbers I'm comparing appear to be equal, the program gives me an ERR message.

## dBASE III

**1.** I have two *dBASE* files that I'm trying to set up using Set Relation, but I can't seem to get the relationship to come out correctly.

**2.** My PC is hooked up to an Epson FX-85 printer. I am trying to create expanded type by using the following escape-code sentence (as specified in the Epson manual):

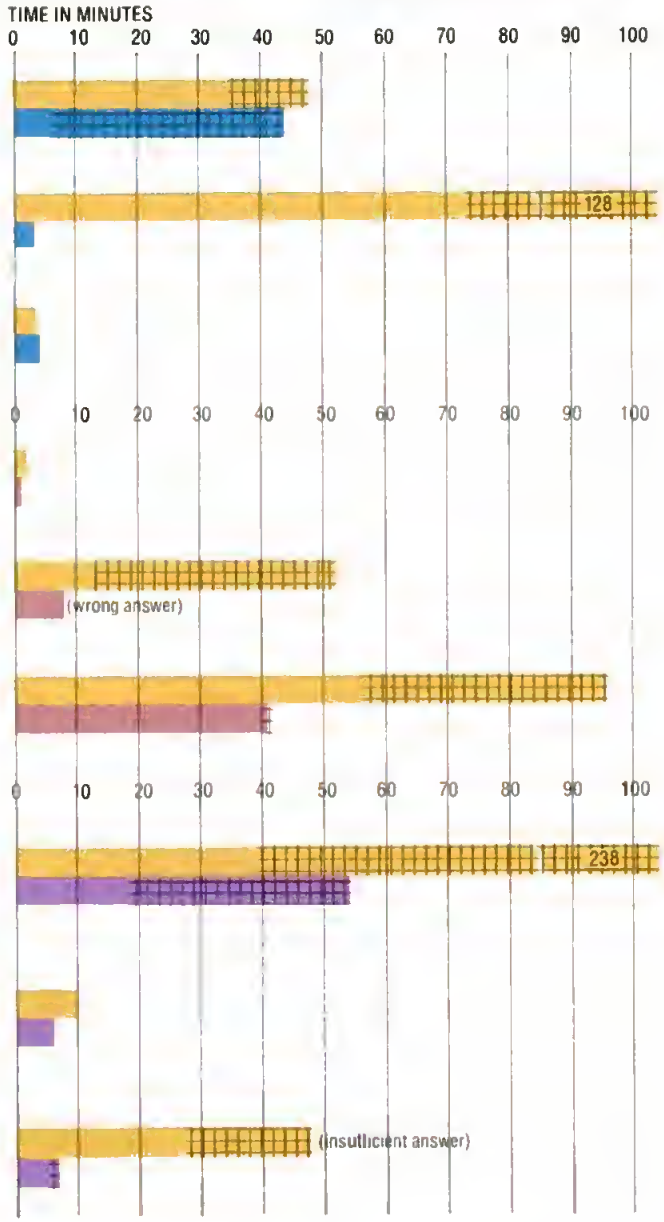
```
?CHR(27)+CHR(87)+CHR(1)
```

That works fine, but then when I try to cancel the Expanded Type command by typing:

```
?CHR(27)+CHR(87)+CHR(0)
```

the type remains expanded.

**3.** I want to run the *dBASE* screen editor. I am in *dBASE* on a computer with two floppy disk drives and 640K bytes of RAM. At the dot prompt I type RUN SED to run it directly off the Utility disk, but I get an error message about insufficient memory and the dot prompt comes back.



down the wrong road. *dBASE III* comes with a screen editing program, SED.EXE, which requires access to a COMMAND .COM file. Floppy-drive users who try to run SED from the Utility disk while still in *dBASE* will receive a deceptive message alleging insufficient memory. Ashton-Tate's technician immediately diagnosed the problem and offered a correct solution; MSR's staff came to the logical but erroneous conclusion that the combination of COMMAND.COM, *dBASE*, and SED .EXE was indeed too much for the computer's memory. They advised me to simply run SED.EXE directly from DOS, which is certainly a reasonable solution, but not the best one.

Ashton-Tate also came out ahead on a question about creating an index for two *dBASE* files that were not relating properly. It took MSR almost 3 hours to solve the problem (40 minutes of that time was spent on the phone). Ashton-Tate solved it in about 18 minutes.

**A TRICKY WORDSTAR PROBLEM**

*WordStar* is one of the most recent packages to be supported by MSR. The company has supported *WordStar 2000* for some time, but, according to Tranberg, "There was virtually no interest in 2000, but we continued to get calls for *WordStar*. So we've added the original *WordStar* because it dominated the market for so long, and the installed base out there is phenomenal."

Supporting *WordStar* can be particularly difficult because of its large user base. A great many versions have come and gone, each with its own eccentricities. *WordStar* 3.30's WINSTALL program, for example, has a problem recognizing systems with more than 512K bytes of memory; when faced with a 640K machine, it subtracts rather than adds the extra 128K and concludes that there is not enough memory in the PC to operate.

I posed this tricky problem to MSR by calling as a new user with a 640K-byte IBM PC-XT who could not understand why the program kept giving me a "Too little memory" message. The technician was so misled by the error message that, even after we ran a couple of CHKDSK tests, she insisted that the problem must be with my hardware, most likely with the

# WHERE TO TURN FOR HELP

*Users with software and hardware problems have several options: product manufacturers, user groups, and independent support companies.*

Your brand-new database program has just swallowed the personnel files for your entire division, and your boss wants a sorted, well-organized report by 5:00 P.M. What do you do?

Don't panic! Several options are available for the harassed computer user who needs help with a hardware or software problem.

If you belong to a large company, your problems may end right there. Companies that buy hardware and software in large quantities often purchase training and support contracts to ensure that all the expensive equipment is used. Many consulting firms offer follow-up support, and one or two manufacturers even offer their own programs. Tandy, for example, offers support through its 60 Customer Training and Support Centers. Finally, the technical staff of your company's data processing department, whose members formerly spent their time nursing mainframes, may now be available to baby-sit new personal computer users.

But service contracts wear out, and in-house programmers don't particularly relish teaching office personnel about the Erase command. The next logical place, according to many microcomputer users, is the vendor.

Until recently, most manufacturers of microcomputer software provided free, unlimited support for their products. Consumers have come to expect over-the-phone help as part of the package. But it costs the vendors money to hire experts, and as user bases expand, the number of calls increases. "Software doesn't wear out," says David Harris, manager of customer services at MicroPro International Corp. "People call us who have used *Wordstar* for 5 years. If you continue to give free help year after year after year, you dig yourself into a hole."

**PREMIUM SERVICE** MicroPro still offers free phone support for its products—and anybody who's ever tried to get through can testify to its popularity. As an alternative to a steady busy signal, MicroPro has introduced a Premium Service Plan: for $95 annually, you get an 800 number and an unlimited number of calls, publication discounts, and a bimonthly newsletter. Between 1,000 and 2,000 MicroPro customers are registered on the plan, which, according to Harris, is working very well. "Our goal is not to become filthy rich from support," he says with a smile, "but to set up a system that pays for itself and allows us to expand services as customers demand it."

Other companies, especially those that sell less expensive products, are looking for more innovative ways to fill the support gap. Borland International

PC MAGAZINE FACT FILE

**Prime Computer Inc.**
**Single Source PC Support**
Prime Park MS 15-94
Natick, MA 01760-9908
(800) PC-CENTR
CIRCLE 697 ON READER SERVICE CARD

**Computer Handholding**
1800 Market St., #91
San Francisco, CA 94102
(415) 864-2343
CIRCLE 696 ON READER SERVICE CARD

**The Boston Computer Society**
One Center Plaza
Boston, MA 02108
(617) 367-8080
CIRCLE 695 ON READER SERVICE CARD

supports Turbo Pascal, *Reflex*, and its other products via the CompuServe telecommunications network. "From the beginning, we got a lot of activity on CompuServe from users who had questions, and it was a very convenient way to relay information to them," says Robin Shepherd, Borland's director of corporate communications. A small technical-support staff monitors the board.

The system has proven so successful that Borland recently split it into two special-interest groups: one for language products, such as Turbo Pascal and Turbo PROLOG, and another for applications products, such as *Reflex* and *SideKick*. The company has also begun a series of on-line seminars on various applications and programming topics.

"Someone can post a question and get a very detailed, thought-through answer back," says Shepherd. "They don't have to sit on the phone. We also put patches for our programs from our data libraries on the forum, so users can access them any time they want. We have an active user base, especially for the languages, and our customers love to put out information."

Often the best and quickest way to get information about a software product is from another user. The guy down the hall who's been using the same word processor for 6 months may have solved that quirk in the underlining function.

**USER GROUPS** But if the guy down the hall is using a different word processor or if you're the bright one whose idea it was to buy that microcomputer in the first place, the best place to go for advice could be your local user group.

User groups have been around since personal computers were merely hobbyists' dreams. They are simply groups of people who share an interest in hardware, software, or applications. They range from five or six people meeting in the cafeteria during lunch to the 21,000-plus membership roll of The Boston Computer Society, which is the largest association of personal computer users in the world according to president Jonathan Rotenberg.

User groups supplement rather than replace vendor support, Rotenberg says. "Support from manufacturers is a lot more consistent than what people get from user groups. But if you go to a user group with a special problem, there's a strong possibility that you'll meet someone else who has experienced that problem. And you'll get a level of support, encouragement, and information that you can't get from the commercial suppliers."

**INDEPENDENT SUPPORT** Last, but perhaps not least, are independent companies, such as MSR, which are beginning to spring up around the country. Right now, their services and customer base vary widely, from Prime Computer's Single Source PC Support, which charges for toll-free phone support on a time-block basis ($130 per hour), to Computer Handholding, which, because it has not yet obtained an 800 number, serves PC and Macintosh users in the San Francisco area only. The odds are that these companies will become a more visible force in the industry over the next couple of years.

The type of support you use depends on your own resources, those of your company, and those of your vendor. But whatever type you choose, you can be sure of one thing—like death and taxes, the need for support has become a given of corporate life.—**Barbara Krasnoff**

disk itself or with one of my memory chips. She recommended running diagnostics on both. Only after I managed to convince her that nothing was physically wrong with the program or the hardware did she finally agree to research the problem. In 13 minutes, she called back with the correct answer.

When I described the same problem to a technician at MicroPro, she immediately told me about Version 3.30's bug and ran me through the same routine that MSR had come up with to fix it. But because MicroPro had nobody available to answer my first call, the total time it took to solve the problem was almost equal for both companies.

MSR's limitations are clearly illustrated by its response to a question concerning *WordStar*'s interaction with a laser printer. In most cases, when working with a laser printer *Wordstar* must send a form feed signal for each page; otherwise the type tends to creep upward as a manuscript progresses. A MicroPro technician diagnosed the problem immediately and told me how to adjust the program, all in a little over 3 minutes.

The technician at MSR was totally stumped. By following MAX's series of questions on *WordStar*, he came to the erroneous conclusion that the page length was at fault and advised me to try varying page lengths until I found one that solved the problem. I had the distinct impression that I was dealing with somebody relatively new to both *WordStar* and to support systems.

After 2 hours and three frustrating phone calls, the question was finally solved by an obviously more experienced technician who quickly ran me through *WordStar*'s WINSTALL procedure and found the proper change in approximately 10 minutes.

**HUMAN HELP** Despite MSR's reluctance to rely on in-house experts, the level of support I received depended on the expertise of the person at the other end of the phone. MSR's effectiveness also seems to depend on how much information the company has on the specific software. In July 1986, for example, 28.1 percent of all calls—the highest percentage—dealt with *1-2-3*. MSR's personnel, therefore, have

more experience with the product and with the types of questions users typically pose. Their superior performance on the *1-2-3* problems reflects this experience.

Robert Woodruff, who handles technical support for the Fortune 500 apparel manufacturer Oxford Industries, has used MSR's AnswerLine for about 6 months. In that time, he says that he has noticed a distinct improvement in its services, mostly due to the staff's increased familiarity with the packages it supports.

"In a lot of cases," Woodruff says, "it takes personal knowledge to interpret the problem. The MAX system is nice, but you can't really substitute it for personal knowledge."

Nor can you substitute it for personal attention. I found MSR operators and technicians very sensitive to their customers' needs. They were always polite and patient, no matter how simple or exasperating the problem. I was never left on hold; a technician who couldn't answer a question within 20 minutes or so would take my number and call me back within two hours. (In several cases, although it took MSR longer to come up with an answer than the vendor, I spent the same amount of time actually on the phone.) I was impressed, too, with their tenacity; only once was I left with an unacceptable answer.

■ MSR is the first of a new breed of computer-support companies, but it is no longer the only one of its kind.

Ultimately, though, MSR technicians cannot claim the expertise that product manufacturers can. Although they easily handle relatively simple questions and can cope with more-complex problems that have logical conclusions, their system breaks down when they are confronted with trickier questions that require an intimate knowledge of the software.

*(continues)*

## Answers for "Testing MSR's Skills—And Yours"

### WORDSTAR

**1.** A glitch in the install program for Version 3.30 causes this problem in systems with more than 512K bytes of memory. WINSTALL.COM believes that you have only 128K (the amount by which you've exceeded 512K). There are three ways to circumvent this problem.

First, you can create a 128K-byte RAMdisk by including the following line in a CONFIG.SYS file:

```
DEVICE = VDISK.SYS 128
```

Second, you can use DEBUG to alter WINSTALL.COM as follows:

```
DEBUG A:WINSTALL.COM
-E2D4
>0C15:02D4 7C.72
-W
[WRITING 0480 BYTES]
-Q
```

You could also load RAM-resident utilities that take up greater than 128K bytes to soak up extra memory.

**2.** Most laser printers require a form-feed at the physical end of the page as a signal to print that page and begin all following text on a new one. You can direct *WordStar* to use form-feeds (instead of single-line scrolling) either by default when you install *WordStar* (through the Special Features option) or by answering yes to the "Use Form-Feeds" question in the print mode.

**3.** You have to fix this *WordStar* quirk manually, by replacing single carriage returns with double carriage returns before double-spacing the document.

### 1-2-3

**1.** To write the change to disk, you must select the Update command. It is listed among the other choices once you change the directory name.

**2.** This happens because *1-2-3* controls the screen directly. The program named LOTUS provides the correct exit routines that your color graphics card needs to restore its ability. You can still skip Lotus's entry program and get right to work with *1-2-3*, but to restore color you'll need to run LOTUS. You can do this automatically with a small batch file:

```
123
lotus
```

Use this file when you enter *1-2-3*, and the batch commands will automatically run LOTUS, where you can type E followed by Y to exit.

A simpler solution is to create a batch file that will automatically run the MODE CO80 command after you leave *1-2-3*.

**3.** Believe it or not, you've just run into the efficiency of the computer. Because of the way computers handle numbers, the computed results of adding 1 and 1 might appear as 2, but your computer may well store this number as 2.00001. While many programs filter out this idiosyncracy, *1-2-3* allows you to work with decimals to 16-digit precision and does not perform this filtering.

One solution is to round out the two parts of the equation before adding them, as follows:

```
@IF(@ROUND(@SUM(C23..K23,023),2)=@ROUND(@SUM(Q7..Q21),2),@SUM(Q7..Q21),0)
```

### dBASE III

**1.** You forgot to use the first table with an index on the related field. The quickest solution is to index on the Code field with a statement such as:

```
INDEX ON CODE TO ICODE
```

**2.** *dBASE III* cannot create the null character that you need to cancel the expanded type. You have several options: write an external routine that you call from within *dBASE* to send this character; use a different set of ASCII codes to expand your print, such as CHR(49) to turn expanded type on and CHR(48) to turn it off; or substitute CHR(128), which is close enough to a null character that the computer may accept it.

**3.** Simple: you do not have COMMAND.COM available on the Utilities disk. Copy it onto the Utilities disk, and the program will work fine. The problem has nothing to do with memory; the error is misleading.

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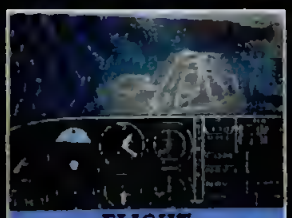

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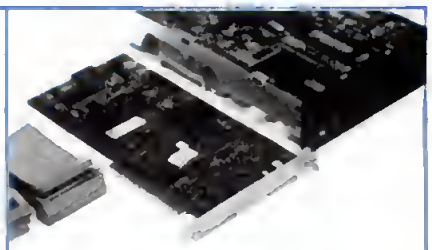

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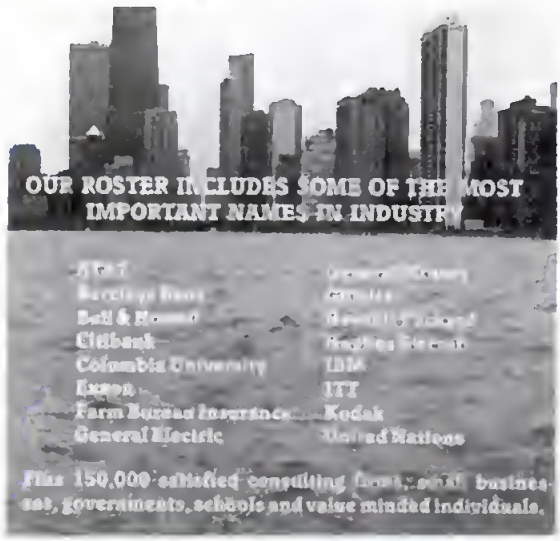


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| **Epson** *FX-85 160CPS 10" Par* | 355.00* | (7.67) |
| ▶ **Epson** *FX-286 NEW! 200CPS/40CPS NLQ* | 440.00* | (9.50) |
| ▶ **Epson** *LQ-1000 NEW! 180CPS/60CPS NLQ* | 699.00* | (15.10) |
| ▶ **Epson** *LX-86 120CPS 8.5 Friction Feed Parallel w/NLQ Switch* | 219.00* | (4.73) |
| ▶ **Epson** *LQ-800 180COL/80CPS Parallel* | $519.00* | (11.21) |
| ▶ **Epson** *LQ-2500 108CPS 132COL Par/Ser* | 995.00* | (21.50) |
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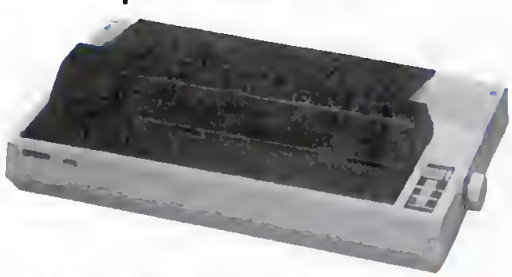

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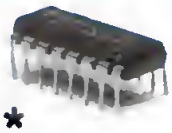

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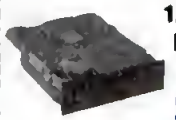

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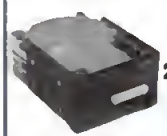

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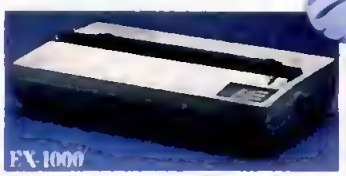


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Leila Shahbender, an information center specialist at Princeton University, started using MSR's support services in December 1985. "The information center supplies support for the administrative staff and their support staff here at the university. We contact MSR if we're presented with a question or problem that we're unable to resolve. I've also called them for things that I could handle on my own if I had the time."

"AnswerLine is pretty convenient," Woodruff agrees. "In a lot of cases, I know I could find the answer, but I don't have the time to look it up or I can't remember what manual it's in. I also use it to get a second opinion. Before I go and tell one of my users something, I call Answerline and say, 'Hey, does this sound right to you guys?' "

According to MSR's Tranberg, the company would like to encourage this type of relationship with corporate information centers. "Typically, an MIS department does consultation, recommendation, and implementation. All of a sudden there are all these little PCs around, and neophytes are calling to ask 'How do I format a disk?' and 'What's that boomerang on the screen?' MIS personnel do not want to deal with that."

MSR is the first of a new breed of computer-support companies, but it is no longer the only one of its kind. At least two more companies have joined them (see sidebar "Where to Turn for Help"), and other companies are sure to follow. Tranberg, however, isn't worried. "Obviously, we can't meet the demands of the entire marketplace—and there's room for a lot of companies," he says. "We do feel that we have a decided advantage and can offer more to the users because of the groundwork we've laid." PC

*Barbara Krasnoff is a frequent contributor to* PC Magazine.


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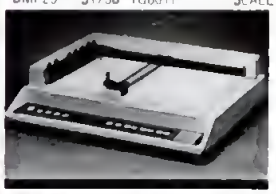

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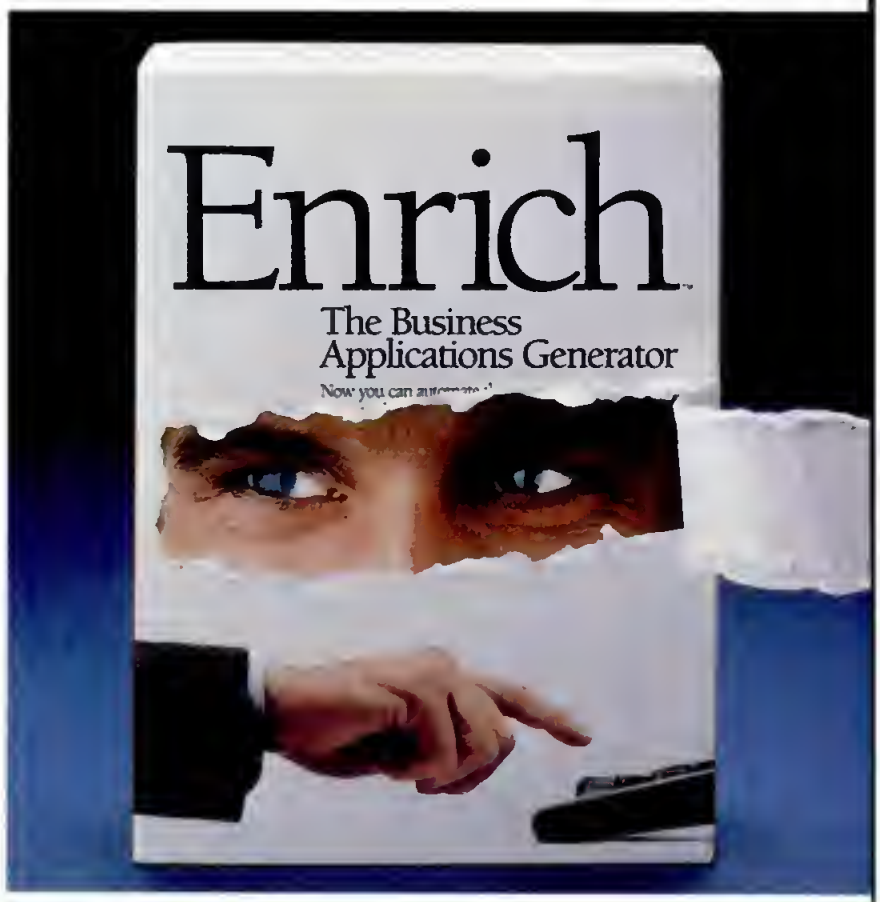


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How do I describe electronic thesauri? *Rapture*? *Joy*? *Enthrallment*? *Bliss*? Let me count the synonyms. If you write often and care about using precise, diverse words, you're a candidate for these new kids on the "extended word processing tools" block.

The word *thesaurus*, of Greek origin, once referred figuratively to any large collection of human knowledge. But the term took on a new meaning in the 19th century, when Peter Mark Roget, a surgeon and accomplished lexical dilettante, began classifying words by meaning as his retirement hobby. To this day, scholars are revising and expanding Roget's classifications. Those of us who lack the patience to make words our study can still reap the practical benefits of Roget's work—by turning to its electronic incarnation.

**ROLL OVER, ROGET** Everyone owns a printed thesaurus, but not everyone uses it. My informal survey suggests that looking up words in a bound thesaurus often leaves people unsatisfied. The search usually involves a number of dead-ends before the ideal word crops up. Of course, searching for a book in the middle of a thought is a distraction in itself.

At best, electronic thesauri are abbreviated versions of their hard-copy counterparts. Yet they have one key advantage: immediacy. These RAM-resident programs work with your applications software to provide a pop-up list of word alternatives at the touch of a key. Looking for the perfect word, you simply press a "hot key"; in a flash, you get a list of possible alternatives. You highlight the best choice with the cursor, and after one more key-

*Electronic thesauri can't guarantee better results than their hardcover counterparts, but they do conjure up synonyms faster and with minimal effort on your part.*

stroke the new word replaces the old.

Although integrated thesauri are added attractions in some word processing packages, the standalone variety reviewed here has the advantage of accommodating more than one applications environment. All the programs I tested are RAM resident. All pop up a list of alternative words. And all can substitute the selected word for the one in your text.

Still, not all thesauri are created equal. Since a good word search inherently depends on the quality of the tools used, a good thesaurus must give you a flexible but intuitive set of searching tools. You should be able to browse the English language, synonym by synonym, until the right word appears. In evaluating thesauri, I focused on the usefulness of the display, the way alternative words were presented and grouped, and, most of all, the variety and richness of the thesaurus dictionary.

**DIFFERENT MERITS** All four of the electronic thesauri I examined are excellent products and useful tools; each has its special merits. Two, *Webster's New World On-Line Thesaurus* and *Word Finder*, are standalone products. (*Webster's New World On-Line Thesaurus* also comes packaged with *Webster's New World Spelling Checker* and *Webster's New World Writer*, and *Microsoft Word* now includes an integrated version of *Word Finder*.) The other two, *Turbo Lightning* and *Random House Reference Set*, combine a thesaurus with a spelling checker using the "reference engine" concept: a central program powers a variety of reference sources.

Each program reviewed has a somewhat different vocabulary. For the word *drunk*, the four provide an array of alternatives. *Word Finder* classifies the word as an adjective and lists *bombed*, *crocked*, *doped up*, *inebriated*, *wired*, *wasted*, and 15 other synonyms. *Webster's New World On-Line Thesaurus* offers only 9 choices, including *intoxicated*, *inebriated*, *muddled*, *flushed*, *tipsy*, and *given to drink*. On the other hand, it produces a "see also" reference for *dizzy*, the synonyms for which automatically appeared in a separate window on my screen. *Turbo Lightning* provides still fewer synonyms, only three. In addition, however, it lists *drunk* as a noun and suggests substitute words like *alcoholic* and *dipsomaniac*. *Random House Reference Set* presents the same list as *Turbo Lightning*, but also notes which synonyms are slang.

These programs, while their approaches are different, share an important similarity: all work better on a hard disk. They use that facility to invoke the thesaurus, retrieving the actual synonyms from a dictionary disk. The programs require about 30K to 50K bytes of resident memory and anywhere from 170K to 276K of precious disk space, depending on the size of the dictionary you choose to install. (Except for *Webster's*, each program offers two dictionaries, small and large, to accommodate the size of your system.) If you don't use a hard disk or RAMdisk, you may find repeated disk-swapping a bigger nuisance than thumbing through your bound *Roget's Thesaurus*.

■ *Reference Set*'s dictionary almost mirrors *Turbo Lightning*'s, but its more flexible user interface allows cross-referencing and browsing.

**CARILLONS AND PIPES (BELLS AND WHISTLES)** *Word Finder* consistently offers the most synonyms, but the following features merit consideration, too.

■ Speed: Run on a PC AT, all four programs are virtually instantaneous. On repeated tests, however, *Word Finder* proved slightly slower than the others. *Turbo Lightning* and *Reference Set* won my speed trials by a bit more than a hair.

■ Display: All four use pop-up windows to display word alternatives. *Webster's New World On-Line Thesaurus* consumes the most screen space; *Turbo Lightning*, the least. *Word Finder* and *Reference Set* conscientiously avoid hiding your document text with their pop-up windows. In its on-screen display, *Webster's* emulates its hardcover ancestor, using a vertical orientation; *Turbo Lightning* also reads vertically. *Word Finder* and *Reference Set* use horizontal windows that cover the top or bottom of the screen.

■ Robustness: *Webster's New World On-Line Thesaurus* is the least fussy of the packages. The others worked best if my cursor was on the last or first letter of the word, and they would sometimes get confused if the cursor was placed in the middle. *Webster's* was also the only program to support word processors (like *Microsoft Word*) that use a graphics mode.

■ Meaning: Each program lists the related words according to parts of speech. *Word Finder* and *Webster's* subdivide further to group words according to shades of meaning, with *Word Finder* generally offering the most refinement.

■ Navigating: *Turbo Lightning* offers the fewest exploration tools. *Word Finder* and *Reference Set* provide better access, allowing you to browse through the thesaurus dictionary. *Webster's New World On-Line Thesaurus* scores best of all here: it lets you meander through related synonyms and can recall and retrace your path. Moreover, with *Webster's*, you can see more than one reference at a time, a handy feature when you need to weigh alternatives.

■ Substitution: By a wide margin, *Webster's New World On-Line Thesaurus* prevails in substitution prowess. Although each of these programs substitutes new words automatically, only *Webster's* can whip the text into shape by monitoring articles, preserving case, and also matching prefix and suffix.

**ACCESSING THE WINNER** For its speed alone, *Turbo Lightning* scores high. Its list of synonyms is comparatively small, however, and the program falls short in accommodating substituted words and providing browsing tools. *Reference Set*'s dictionary almost mirrors *Turbo Lightning*'s, but its more flexible user interface allows for cross-referencing and browsing. *Word Finder*'s extensive list of synonyms makes it the hands-down winner in the count-'em-up category and the most stimulating purveyor of food for thought. And *Webster's New World On-Line Thesaurus* wins handily in the bells-

and-whistles contest: it provides the most-advanced capabilities in referential searching and word substitution.

## Turbo Lightning

Created in 1985, Borland International's *Turbo Lightning* initially won praise as a revolutionary "information engine," the hub of a series of reference programs (see "A Spark of Lightning," *PC Magazine*, Volume 4 Number 25). When it first announced *Turbo Lightning*, Borland said it would soon offer vast stores of retrieval information, including electronic versions of *Roget's*, *Bartlett's Familiar Quotations*, *Black's Dictionary of Law*, and medical dictionaries, among others. Borland has yet to make good on those promises. Today, *Turbo Lightning* still contains only its original two components: electronic versions of *The Random House Dictionary* and *The Random House Thesaurus*.

Nonetheless; *Turbo Lightning* is a well-conceived tool for writers, with good integration of a spelling checker and a thesaurus. And this is one program that lives up to its name—it's fast, thanks to sophisticated compression techniques.

*Turbo Lightning* includes a main system disk, a dictionary disk, and a disk of supplemental files, including a macro facility. The installation procedure is incredibly flexible: the spelling-checker and thesaurus dictionaries come in a small or a more complete large size, and five different-size RAM dictionaries accommodate your system's memory size. Unlike the other four programs, *Turbo Lightning* can take advantage of expanded memory above 1 megabyte. It lets you select "environments" on the fly, and so the program can easily accommodate your various applications without the need for rebooting or reinstallation. On the debit side, *Turbo Lightning* components can't be purchased separately, and both the spelling checker and the thesaurus must be installed.

You can invoke the thesaurus directly through an Alt-"hot key" or by accessing a pull-down menu and selecting Thesaurus. The synonyms pop up in a colorful window. But because of the compression techniques used to bring its entries to the screen fast, *Turbo Lightning* doesn't put the words in any discernible order, alphabetic or otherwise. It groups them only by parts of speech.

The thesaurus contains 50,000 synonyms that can be accessed through 5,000 root words. Yet the program is a bit stingy in how it lets you manipulate those words. For example, it doesn't allow you to look up the synonym of a synonym. If you looked up *speech*, one of the 16 choices offered would be *utterance*. To find synonyms for that word, you'd have to reenter the thesaurus with the word *utterance* in your document.

Even if you tried that, you'd be out of luck. While the program supplies an ample list for commonly used root words, most of the synonyms referenced are not root words themselves. So *Turbo Lightning* can't provide synonyms for *utterance*—or for other synonyms of *speech*, like *parlance*, *tongue*, or *discourse*.

If *Turbo Lightning* can't find a word (and it often can't), you can press a function key to view a list of "close" words. By close, however, Borland means close alphabetically. Usually that's no help, but occasionally it allows you to search for cognates.

In general, *Turbo Lightning*'s synonyms are accurate but limited. Its dictionary contains only a quarter of the entries found in that of comprehensiveness-champ *Word Finder*. For *art*, *Word Finder* lists 74 references; *Turbo Lightning* offers only 10. On the other hand, *Turbo Lightning* picks its words carefully: it provides a healthy 13 synonyms for *business* (versus 65 in *Word Finder*) and 10 for *money* (including some weirdos, such as *long-green* and *mazuma*).

*Turbo Lightning* cooperates well with Borland's slew of RAM-resident programs such as *SideKick* and *SuperKey*. For instance, it can automatically sense when *SideKick* is active and can reconfigure itself accordingly. *Turbo Lightning* may be sensitive to the needs of the Borland family, but it can be brutish with other applications. Although it supports *Microsoft Word*, the program could not read my input from the screen, even when I turned off the graphics display. To use *Turbo Lightning* with *Word*, I had to type the query word from the keyboard.

## Random House Reference Set

Although Borland popularized the reference-engine concept, Reference Software's *Random House Reference Set* originated it. The programs are indeed similar. Both are equally fast. Both have the same reference sources, the bound *Random House Dictionary* and *Random House Thesaurus*. Both include two similar-size dictionaries in their trio of disks.

PC MAGAZINE FACT FILE

***Turbo Lightning***
Borland International Inc.
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(408) 438-8400
**List Price:** $99.95
**Requires:** 128K RAM, two disk drives, DOS 2:0 or later.
**In Short:** A RAM-resident reference library, *Turbo Lightning* includes an 83,000-word spelling checker and a 50,000-word thesaurus based on the hardcover *Random House Dictionary* and *Random House Thesaurus*. Not copy protected.

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PC MAGAZINE FACT FILE

***Random House Reference Set***
Reference Software
330 Townsend St., #135
San Francisco, CA 94107
(800) 826-2222
**List Price:** $69; $20 additional for spelling checker.
**Requires:** 128K RAM, two disk drives, DOS 2.0 or later.
**In Short:** *Reference Set* uses the same RAM-resident format, the same reference engine concept, and the same 50,000-word dictionary as *Turbo Lightning*. Unlike that program, however, *Reference Set* offers its spelling checker and thesaurus separately, and its user interface allows for browsing and typed-in queries. Not copy protected.

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The differences, however, are important. You can purchase and install *Reference Set*'s modules separately, which is not an option with *Turbo Lightning*. (In fact, at press time, Reference Software was about to release a 300,000-word thesaurus and some foreign-language dictionaries that would use its reference engine.) While *Turbo Lightning* offers more options for installation, *Reference Set* simplifies the installation process. The program asks a series of questions, including choices for word processor, graphics display, preferred "hot keys," directories, and pathnames. Even those who despise installation won't mind this one.

A still more important distinction lies in the options offered within the thesaurus itself. Although *Reference Set* and *Turbo Lightning* are derived from the same hardcopy dictionary and invariably produce the same list of words, their user interfaces are quite different. *Reference Set* offers more electronic maneuverability. For one thing, it allows for cross-referencing. You can look up a synonym for a synonym by moving the cursor to a given entry and pressing the Plus key. You can also page up and down to browse through the contents of the thesaurus—a function *Turbo Lightning* won't allow.

Alt-T invokes the thesaurus. If the word is in the dictionary, the synonyms pop up in a window located strategically so as not to displace text. If *Reference Set* can't find a word, the program, for reasons that still elude me, tells you where the word "would have been." When I tried to look up *donkey*, the display read, "*Donkey* is not included in the thesaurus. It would be between *done* and *doom*." I suppose this is helpful in dealing with suffixed words, but it seems mostly superfluous. Another esoteric feature is the program's ability to replace occurrences of the same word in your document with a synonym stored in a glossary. Yet *Reference Set* doesn't adjust words automatically (for case, suffix, and so on) as it substitutes them in your text.

The display is attractive. While the other programs reviewed use color decoratively, *Reference Set* uses it functionally, to illustrate parts of speech. As you scroll through the synonyms, they appear highlighted or in bold, depending on your own preference. But *Reference Set*'s display shares one of *Turbo Lightning*'s major weaknesses: the synonyms don't appear in alphabetical order.

## Word Finder

*Word Finder* is unquestionably the word-maven's choice. The hardcover *Roget's Thesaurus*, 4th edition, contains approximately 250,000 words and phrases; next in line is *Word Finder*, with more than 200,000 synonyms. The program lists 74 alternatives for *art*, 62 choices for *jump*, and enough synonyms for *sexy* to fill a 42nd St. marquee.

*Word Finder* has seen several incarnations. Previous versions sported a less valuable dictionary, but Version 3.1 has overcome past difficulties. Packaged on a single floppy disk, *Word Finder* offers a smaller, 90,000-synonym dictionary (with 9,000 root words) and the walloping 220,000-synonym version (with 20,000 root words). *Word Finder*'s small dictionary outstrips most other programs' larger ones.

Each of the other thesauri follows a single hardcover gospel (either *Random House* or *Webster's*), but *Word Finder* is freewheeling in its allegiances. It uses an amalgam of sources that results in a thoroughly modern, often whimsical set of alternative words. More than the other three, *Word Finder* reflects the lively usage of our language.

*Word Finder* also bears the closest structural ties to the ever-popular bound *Roget's Thesaurus*. The only hardcover thesaurus to organize words by meaning, as well as alphabetically, *Roget's* lets you search a word in the context of an idea and then follow annotations from the idea index into the thesaurus proper. The results are good if you have the gumption. For example, you can look up the word *clear* and pursue its various meanings according to the notion of acquittal, transparency, or audibility, to name a few.

*Word Finder* follows the same tack in a more straightforward way, organizing its pop-up word list according to variations in meaning. When you call up the program, the related word list appears horizontally across the screen. Commas separate the words, but semicolons and line breaks separate categories of meaning. So, with *Word Finder*, the entry for *clear* cites 18 word categories related to both the verb and the adjective. The list includes *barren*, *absolute*, and weather-related words such as *cloudless*. *Webster's New World On-Line Thesaurus* also uses these categories but less comprehensively.

Grouping the words into functional areas marks a big improvement over other thesauri. Unfortunately, the visual presentation hinders the process: the semicolon, for example, blends in with the comma. A better visual scheme would enhance the separation of categories.

Because *Word Finder* offers such a wealth of synonyms, users who aren't lexically adept to begin with may get into trouble. The program occasionally stretches the limits of kosher alternative usage and sometimes appears to rely more on free association than on rigid equivalence. Is *donate* really a synonym for *volunteer*? Can you really say *decorum* or *expediency* when you mean *advantage*? I'd balk at substituting a $64 word for a 35-cent one unless I could check a dictionary. The other programs may have limited scope, but they offer more true synonyms and fewer merely related words than *Word Finder*.

*Word Finder*'s dictionary will wow you, but its functions may disappoint you. You can't type in a query word from inside the thesaurus. The program doesn't preserve prefix and suffix endings like *Webster's* does. You can, however, move from one related word to another and back

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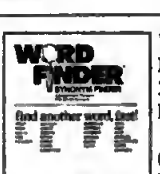


***Word Finder***
Microlytics Inc.
300 Main St.
East Rochester, NY
14445
(716) 248-9150
**List Price:** $79.95
**Requires:** 128K RAM, two disk drives, DOS 2.0 or later.
**In Short:** The thesaurus with the largest vocabulary, this RAM-resident program offers 220,000 synonyms and allows you to look up the synonym of a synonym. Not copy protected, but it includes a "personalization screen."

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again. And, to its credit, *Word Finder* places its pop-up window so that you can still view your document.

The next time you want to call someone an idiot, check this thesaurus. Your options will astound you.

## Webster's New World On-Line Thesaurus

If *Word Finder* is a candy store of words, *Webster's New World On-Line Thesaurus* is a feast of functions. *Webster's* maximizes the benefits of the electronic medium, providing a superior technical presentation.

*Webster's* comes either as a standalone package that supports most popular word processors or as part of the *Webster's New World Writer* word processing package, which includes *Webster's New World Spelling Checker*. The word processing component, in fact, came out after the spelling checker and thesaurus, in response to their success.

Like the others, *Webster's* is memory resident, using 44K bytes of RAM. The disk contains a single dictionary with more than 100,000 synonyms for 20,000 root words. An easy-to-use setup screen allows you to specify your word processor and

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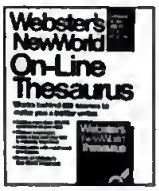


***Webster's New World On-Line Thesaurus***
Simon & Schuster Software
Gulf + Western Bldg.
One Gulf + Western Plaza
New York, NY 10025
(800) 624-0023
**List Price:** $69.95
**Requires:** 128K RAM, two disk drives, DOS 2.0 or later.
**In Short:** A 100,000-synonym electronic version of the hard-copy *Webster's New World Thesaurus*. This program has a variety of word search tricks up its sleeve: it can look up synonyms of synonyms, uses related references, and maintains grammatical continuity when substituting a word. Not copy protected.

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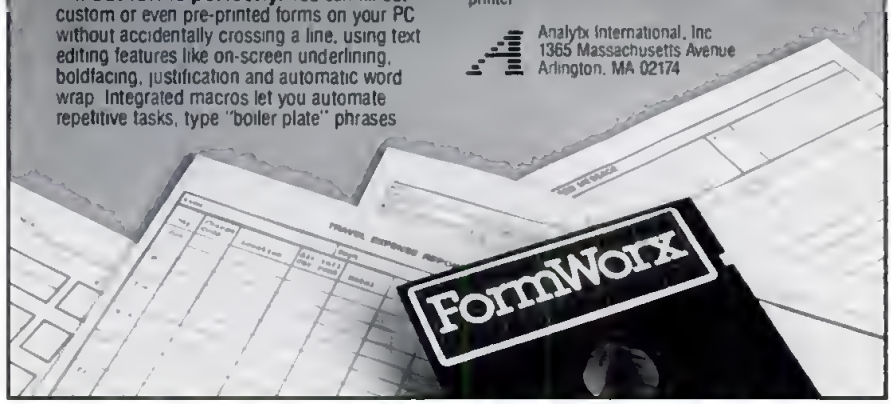


*Includes normal handling and shipping. Add $5 for foreign, COD, and POs.

Requirements: IBM PC with 320 KB and DOS 2.0 or higher. Works with or without a graphics board. FormWorx is a trademark of Analytx International, Inc.

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## Electronic Thesauri: Summary of Features and Performance

| Product/ Manufacturer | | Random House Reference Set Reference Software | Webster's New World On-Line Thesaurus Simon & Schuster Software | Word Finder Microlytics Inc. | Turbo Lightning Borland International Inc. |
|---|---|---|---|---|---|
| **LIST PRICE** | | $69.00 ($20 extra for speller) | $69.95 | $79.95 | $99.95 |
| **FEATURES** | | | | | |
| | Number of synonyms claimed | 80,000 | 120,000 | 220,000 | 50,000 |
| | Number of root words claimed | 5,000 | 20,000 | 15,000 | 5,000 |
| | Contains limited and expanded memory versions | ● | ○ | ● | ● |
| | RAM required | 43K | 44K | 30K | 65K |
| | Disk space required | 208K | 360K | 322K | 160K |
| | Can uninstall without reboot | ○ | ● | ○ | ●, with caution |
| | Can assign hot key | ● | ● | ● | ● |
| | Preconfigured programs | 23 | 26 | 24 | 18 |
| | Allows typed-in lookups | ● | ○ | ○ | ○ |
| | Looks up synonyms for synonyms | ● | ○ | ● | ○ |
| | Can browse alphabetically | ● | ○ | ● | ○ |
| | Tracks and retraces search | ○ | ○ | ● | ○ |
| | Categorizes parts of speech | ● | ○ | ● | ○ |
| | Categorizns shades of meaning | ○ | ○ | ● | ○ |
| | Undo feature | ○ | ● | ○ | ○ |
| **PERFORMANCE: WORD SEARCH** | | | | | |
| **Supplying rnfnrnncns** | Number of references supplied for: | | | | |
| | art | 10 nouns | 15 nouns<br>7 cross-references<br>4 categories of meaning | 74 nouns<br>3 categories of meaning | 10 nouns |
| | eccentric | 7 adjectives<br>2 nouns | 2 adjectives<br>1 cross-reference<br>1 category of meaning | 7 nouns<br>8 adjectives<br>3 categories of meaning | 7 adjectives<br>2 nouns |
| | long-winded | None | 2 adjectives<br>1 cross-reference<br>1 category of meaning | 12 adjectives | None |
| | stuck | None | 6 adjectives<br>3 cross-references<br>3 categories of meaning | None | None |
| | profit | 8 nouns<br>2 verbs | 5 nouns<br>5 verbs<br>2 cross-references<br>4 categories of meaning | 46 nouns<br>35 verbs<br>5 categories of meaning | 8 nouns<br>2 verbs |
| **Hyphnneted words** | You type "x-rated"<br>It substitutes: | (No words found) | (No words found) | 31 words | (No words found) |
| **Sleng words** | You type "hip"<br>It substitutes: | (No words found) | 5 slang words | 8 slang words | (No words found) |
| | You type "rap"<br>It substitutes: | (No words found) | 3 slang words | 9 slang words | (No words found) |
| **Foreign words** | You type "tour-de-force"<br>It substitutes: | (No words found) | (No words found) | (No words found) | (No words found) |
| | You type "smorgasbord"<br>It substitutes: | (No words found) | 4 words | 8 words | (No words found) |
| **Phreses** | You type "state of the art"<br>It substitutes: | (No words found) | (No words found) | (No words found) | (No words found) |
| | You type "day after day"<br>It substitutes: | (No words found) | "daily" | (No words found) | (No words found) |
| **PERFORMANCE: REPLACEMENT** | | | | | |
| **Article ngrnemnnt** | You type "an nttractive"<br>It substitutns: | (No words found) | "an good looking" | "an desirable" | (No words found) |
| **Cese egrnemnnt** | You type "tunes"<br>It substitutes: | "musical" | "melodies" | "air" | "melody" |
| **Suffis end prnfis mntching** | You type "analyzing"<br>It substitutes: | "examine" | "dissecting" | "annotate" | "examine" |
| | You type "recalculate"<br>It substitutes: | (No words found) | "reenumerate" | (No words found) | (No words found) |

—Indicates Editor's Choice. ●—Yes ○—No

"hot keys," the disk drive location of your dictionary, and pathnames. More than the other three programs, *Webster's* accommodated my pesky *Microsoft Word* environment.

The program tries to resemble its hard-copy counterpart visually. When you look up a word, the pop-up screen shows guide words—the previous and next entries in the dictionary—on the top line. It also lists and numbers the categories of synonyms and shows parts of speech.

*Webster's* stands apart in its use of "see also" references. Select the word *eat*, for example. Under the category that refers to *eat* as a synonym for *worry*, a reference reads "see *bother*." What's more, if *bother* were the only related reference, the word would automatically pop onto the lower portion of the screen with its accompanying synonym list. For words with more than one "see also" entry, you can call up a particular reference by scrolling to it and pressing Enter.

■ Even though you can initiate over a dozen commands once you've invoked the thesaurus, *Webster's* makes absolute intuitive sense.

Even though you can initiate more than a dozen commands once you've invoked the thesaurus, the program makes absolute intuitive sense. A pop-up help screen provides a functional synopsis of the commands. *Webster's* lets you mosey from reference to reference without making you leave and reenter the thesaurus; it keeps track of the journey and can retrace your path. It also has a pop-up note page for keeping a list of words you may want to use. And one keystroke will undo the substituted word if you've made a mistake.

Next to the other programs, *Webster's* excels in its options for exploration. Look up *eclectic* and *Webster's* offers *selective*,


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*general*, and *universal*. If you want to investigate further, scroll down to *universal* and press Return. An alternate entry page pops up with synonyms for *universal*, including *cosmic*, *worldwide*, and *tellurian*. You can continue exploring in this manner, flipping between two full pop-up screens, until you're satisfied. If your search isn't fruitful and you want to pursue another avenue, simply type in the next word and invoke the alternate entry page. *Reference Set* does something similar, but it can't provide the two-page layout. Only with *Webster's* can you pursue two tactics and compare.

■ *Webster's* ranks high because of its uninstall feature—you can deactivate the program without rebooting.

**GRAMMATICAL SYNONYMS** *Webster's* shines during the automatic replacement process. It preserves prefixes and suffixes from your search word when it substitutes the thesaurus's word. When you look up *alleviating*, you'll see synonyms for *alleviate*; if you select *relieve* as the synonym, *Webster's* is smart enough to ask whether you want *relieve* or *relieving* as the replacement. The system does occasionally blunder, however: when I tried *experimenting* it attempted to substitute *examinationing*, and when I typed *observing* it responded with *alert*. On the other hand, if it doesn't always give the right answers, the program's attempts at perfect substitution will please anyone who loves word play. When I typed *recalculate*, *Webster's* offered synonyms for *calculate*, but it asked if I wanted to substitute *figure*, *figure again*, or *refigure*, as well as *reckon*, *rereckon*, or *reckon again*.

More than the other packages, *Webster's* accommodates phrases, like *point of view* and *bring about*, and hyphenated compounds, like *thick-skinned*. Again, you may or may not strike pay dirt. I couldn't find *state of the art* or *bric-a-brac*. Still, because *Webster's* is instantaneous and because it asks you to confirm your replacement before it mucks with your document, you're willing to give it your best shot.

*Webster's* also ranks high in my book because of its uninstall feature—you can deactivate the program without rebooting. *Turbo Lightning* has a similar feature, but it's sensitive and potentially disastrous if you've loaded other resident programs. And, finally, the manual for *Webster's New World On-Line Thesaurus* is delightful. Not only does it provide incisive documentation for installation and operation, but it contains a word-usage appendix that's sine qua non. It's like having Strunk and White's *Elements of Style* tossed in for free.

**INTEGRATED THESAURI** *MultiMate*, *WordPerfect*, and *Bank Street Writer* are among the word processors that include their own thesaurus programs, and the number is growing. Also, several word processing programs use the equivalent of the standalone thesauri. *Webster's New World Writer* incorporates *Webster's New World On-Line Thesaurus*, and *Microsoft Word* now integrates *Word Finder*.

Integrated thesauri are adapted specifically to their word processing environments. For example, in the new version of *Microsoft Word*, *Word Finder* automatically traps the keystrokes of the last word in the document. *Bank Street Writer* provides its own thesaurus and allows you to trail a word for related references. *WordPerfect*'s thesaurus supplies you with no more than three synonyms or related words per query. If you use these word processors already, you're in luck; if you're shopping for a complete package, a word processor with a thesaurus module may be the most desirable alternative.

**THE FUTURE IN CD-ROM** Because our minds tend to wander, hardcover thesauri can be dangerous. When you open a bound thesaurus, you open a Pandora's box: you're likely to read and roam until your original goal evaporates. These books seem better suited for armchair reading than for the dirty work of finding the best word fast. Electronic thesauri, by contrast, work fast enough to be useful.

On the other hand, many searches that succeed on paper fail electronically. No electronic thesaurus approaches the scope of the hardcover version of *Roget's*. The other day, I needed an antonym for *aging*. I had no problem finding *youthen* in my bound *Roget's* but came up with zilch on the electronic versions. If you seek a word that captures an idea—for example, "a big number"—an electronic thesaurus won't help you locate *zillion*. And only bound versions supply the more-literary synonyms, like *Walter Mitty* or *Artful Dodger*. *Roget's Thesaurus*, 4th edition, lists hundreds of references for *art*, with three pages devoted solely to art styles, movements, and jargon. And if the English language falls short, the hardcopy version supplies foreign derivations, like *tour de force* and *aperitif*.

Where hardcover thesauri serve a rich cuisine, their electronic counterparts sometimes seem to give only bread and water. But it may not be that way for long. My crystal ball predicts that CD-ROM will supply the medium necessary to enrich the electronic thesaurus. Disk-based thesauri

**PC MAGAZINE EDITOR'S CHOICE**

*If you're looking for sheer freedom of choice,* ***Word Finder*** *will thrill you. This program offers a motherlode of shades and categories of meaning.* ***Webster's New World On-Line Thesaurus*** *combines a strong thesaurus dictionary with the marvels of the electronic medium. The screen resembles the page of a bound thesaurus, but you can browse electronically through related references, making notes and recalling your path as you go. The automatic replacement can undo mistakes and tries to preserve case and endings in your document. Try this package if you want a short, sweet list of synonyms instead of* Word Finder*'s wider-ranging approach.*

can store only limited amounts of information, accessed slowly; a CD (compact disk) can hold all of *Roget's* in a minute space and access it instantly. Today's electronic thesauri are but the first generation. As CD-ROM becomes more useful, so will these tools.

In fact, CD-ROM could make a complete word-usage library available. In addition to housing a thesaurus, spelling checker, and style checker on-disk, CD-ROM could offer a "meaning dictionary," making inappropriate word choice less likely. With a CD, you could press a key from within the thesaurus to activate a dictionary of meaning. As it stands now, many of us might not substitute *loquacious* for *talkative* or *salubrious* for *healthful* without consulting a dictionary to confirm our choices.

■ Bound thesauri seem better suited for armchair reading. Electronic thesauri work fast enough to be useful.

Computers are often accused of promoting poor writing habits, of being product oriented, and of exalting productivity above all else. Word processors, it is said, speed up a document's creation and revision but don't make it better. Experts tell us that sentences written on word processors tend to be short, with screen-length thoughts. Because of the ease of writing and editing, quality becomes scarcer and documents become longer. But length doesn't necessarily bring variety; most business correspondence relies on a group of about 3,000 words, used ad nauseum.

Electronic thesauri are one of the few process-oriented genres in a world in which products count. They make us more-efficient writers because our words are more accurate. PC

*Robin Raskin is a frequent contributor to* PC Magazine.


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| 12 MB Floppy | |
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| One Year Warranty | |
| Serviced by TRW Nationwide | |
| Multitech softwhite + Card | 219 |
| Multitech color + Card | 359 |
| Multitech EGA + Card | 299 |
| Multitech 3 MB RAM Exp OK | 219 |
| **PCA 8 MHz 640K 20 MB – 1 floppy parallel, serial, clock & game** | 995 |
| **PCA 8 MHz 640K 1 floppy** | 429 |
| **PCA 8 MHz 640K – 2 floppies, monitor, card, par., ser., clock & game** | 775 |

### Desktop Computer

| | |
|---|---|
| IBM PC AT 512K | 2975 |
| **Compaq Deskpro 386 512K** | 6900 |
| IBM PC XT 640K | 1745 |
| IBM PC 256K | 995 |

### Transportable Computer

| | |
|---|---|
| Compaq Portable 286 | 3100 |
| Compaq Portable Computer | 1529 |
| Compaq Port II Model 4 | 3685 |
| Compaq Portable Plus | 1529 |

### Lap-Size Computer

| | |
|---|---|
| **Toshiba T1100+** | 1075 |
| Toshiba T3100 | 3895 |

### Floppy Disk Drive

| | |
|---|---|
| Teac 55BV 360K | 29 |
| Teac FG 1.2MB | 148 |
| Toshiba ND 040 360K | 95 |
| Toshiba ND 080EG 1.2MB | 149 |
| Fujitsu 360K | 29 |

### Hard Disk Drive

| | |
|---|---|
| **Seagate ST225, 20MB HH** | 379 |
| **Seagate ST229, 30MB HH** | 479 |
| **Seagate ST4029, 20MB** | 529 |
| **Seagate ST4038, 30MB** | 929 |
| **Rodime 203E, 30 MB** | 429 |
| **Seagate ST4051, 40 MB** | 729 |
| **CDC 9415-29, 80MB** | 1299 |
| Western Digital 1002 | 129 |
| Western Digital WA2 | 238 |
| Western Digital WAH | 189 |
| Disk Manager Software | 99 |

### Alternative Mass Storage

| | |
|---|---|
| Bernoulli Box 20+20+80 | 3995 |
| **Everex Stream 60 ext** | 695 |
| Everex 60 internal | 515 |
| Alloy 60MB external | 765 |
| Irwin 10MB internal | 386 |

### Diskettes and Tapes

| | |
|---|---|
| 3M DC 600A cartridge | 26 |
| 3M DC 1000 cartridge | 19 |
| Bernoulli 20MB cartridge | 72 |
| Maxell MD2 DM 10 disks | 18 |
| Maxell MD2 HD 10 disks | 39 |

### Color Monitor

| | |
|---|---|
| Princeton HX-12 | 442 |
| **Princeton SR-14 770 × 400** | 429 |
| **Thompson color RGB** | 299 |
| Taxan 630 | 450 |
| Taxan 940 | 515 |

### EGA Color Monitor

| | |
|---|---|
| **NEC Multisync** | 799 |
| Princeton HX-12 E | 529 |
| Multitech EGA | 419 |
| Samsung EGA | 399 |

### Monochrome Monitor

| | |
|---|---|
| **Samsung amber / green / TTL** | 85 |
| Amdex 310A TTL amber | 199 |
| Princeton MAX 12 amber | 195 |
| Multitech soft white TTL | 119 |

### Printer – Dot Matrix Near Letter Quality

| | |
|---|---|
| Epson LQ-1000 | 630 |
| Epson FX 226 | 569 |
| Epson FX 85 | 434 |
| IBM Proprinter | 415 |
| IBM Proprinter XL | 629 |
| **Citizen 1200 120 CPS** | 180 |
| Citizen MSP 10 160 CPS | 307 |
| Citizen MSP 15 160 CPS | 414 |
| Okidata 182 120 CPS | 228 |
| Okidata 292+ 216 CPS | 399 |
| Okidata 193+ 216 CPS | 595 |
| Panasonic KXP 1091 120 | 270 |
| Panasonic KXP 1092 180 | 348 |
| NEC P5 290 CPS | 1053 |
| NEC P5 XL 290 CPS | 1192 |
| NEC P6 216 CPS | 475 |
| NEC P7 216 CPS | 995 |
| Nissho 24 wire, 540 CPS | 1990 |
| **Toshiba P-321 216 CPS** | 442 |
| **Toshiba P-341 216 CPS** | 529 |
| **Toshiba P-351 300 CPS** | 949 |
| **Toshiba P-351 220 CPS** | 1135 |
| **Brother 1509 180 CPS** | 329 |

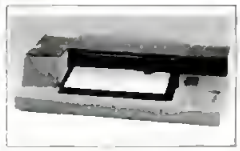
### Printer – Letter Quality

| | |
|---|---|
| Citizen Premier 35 CPS | 517 |
| Brother HR-15XL 17 CPS | 388 |
| Brother HR-35 35 CPS | 595 |
| NEC Spinwriter 3550 | 799 |
| IBM Quietwriter | 1215 |

### Printer – Laser

| | |
|---|---|
| H P Laserjet 500 | 3650 |
| H P Laserjet Prof | 2350 |
| H P Laserjet Plus | 3000 |
| Cannon LBP-8A 1P | 2150 |
| Cannon LSP-8A 2P | 3000 |

### Plotter



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|---|---|
| HP 7475 A Plotter | 1744 |
| Houston Ins. DPM 56 | 5188 |
| Roland 880 8 pen | 966 |

### Input Device

| | |
|---|---|
| Microsoft Mouse | 115 |
| Mouse System Mouse | 129 |
| Logic Mouse | 85 |

### Graphics Board, Monochrome

| | |
|---|---|
| Hercules Graphics Card *(New!)* | 194 |
| Everex Edge Mono/RGB/132col | 229 |
| ATI Mono/color/high/res | 229 |
| Clone monochrome graphic | 95 |
| Persyst Bob/MG mono/RGB | 171 |

### Graphics Board Color

| | |
|---|---|
| Paradise Mod Graphics | 248 |
| Hercules Color Graphics *(New!)* | 149 |
| Clone Color Graphics | 85 |

### Graphics Board EGA

| | |
|---|---|
| Paradise EGA/Auto Switch | 359 |
| Video 7 Deluxe/Auto | 399 |
| Multitech EGA | 229 |

### Modem

| | |
|---|---|
| **US Robotics Direct 1200** | 149 |
| US Robotics 1200 PC INT | 129 |
| US Robotics 2400 PC INT | 129 |
| Everex Evercom 1200 | 129 |

### Memory Expansion

| | |
|---|---|
| **AST Premium 256K 2 MB SixPakPlus** | 234 |
| **Clone SixPack** | 99 |
| **AST Rampage PC** | 234 |
| **AST Rampage AT** | 445 |
| **Tall Tree J-Ram 3** | 184 |

### I/O Board

| | |
|---|---|
| 2 Floppies P/S/C/G/ | 29 |
| AT I/O P/S | 99 |

### Chips

| | |
|---|---|
| 256K 150 Nano | 27 |
| 256K 120 Nano | 29 |
| 64K 150 Nano | 9 |
| 8087 | 119 |
| 80287 2 | 129 |
| 80287 3 | 129 |
| 80287-8 | 399 |

## SOFTWARE

### Accounting

| | |
|---|---|
| Dac Easy Accounting | 45 |
| Accounting Software, BPI | 299 |
| Open System Account Soft | 399 |
| PCAmerican Accounting | 1895 |
| Time Line * Breakthrough | 262 |

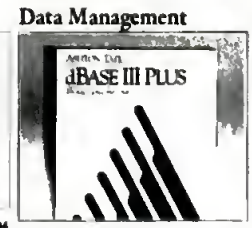
### Applications Integrator

| | |
|---|---|
| Microsoft Windows Microsoft | 85 |
| Desqview Quarterdeck | 29 |

### Communications

| | |
|---|---|
| Crosstalk XVI Microstut | 119 |
| Smartcom II Hayes | 88 |

### Data Management

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|---|---|
| dBASE III Plus Ashton T | 399 |
| R Base 5000 Microrm | 305 |
| Reflex Borland | 29 |
| Paradox Ansa Software | 442 |
| Clipper | 348 |
| Ext Report Writer | 85 |
| Cloud 2 | 139 |
| DGraph III | 149 |
| Quickcode III | 145 |
| Quick Report | 139 |

### Desktop Management

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|---|---|
| Sidekick Borland | 29 |
| The Desk Organizer Worn | 85 |

### Education

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| Study Program for SAT | 47 |
| Math Blaster | 25 |
| Early Learning Series | 33 |
| Newsroom Springboard | 30 |

### File Management

| | |
|---|---|
| PFS File, Software Pub | 78 |
| PC File III Buttonware | 99 |

### Financial Modeling

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|---|---|
| 1-2-3 Lotus | 305 |
| Javelin Javelin Software | 549 |

### Games

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|---|---|
| Scenery Disks Western US | 72 |
| Flight Simulator Microsoft | 32 |
| Jet SubLogic Communication | 33 |
| Sargon III Hayden Software | 29 |
| Zork I, II, and III Inf | 29 |
| F-15 Strike Eagle MicroPro | 29 |
| Winter Games Epyx | 29 |
| Temple Of Apshai Trilogy | 29 |
| Movie Monster – The Game | 29 |
| World e Greatest Baseball | 29 |
| Comp Novel Construction Set | 29 |
| Black Cauldron Sierra | 29 |
| Silent Service, Microprose | 29 |

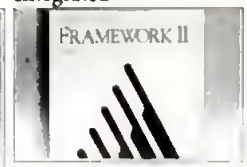
### Graphics – Business

| | |
|---|---|
| Charter Master Decision Re | 220 |
| Microsoft Chart Microsoft | 178 |
| 1-2-3 Lotus | 305 |
| Freelance Lotus | 224 |
| Harvard Presentation Graphics | 299 |

### Graphics – CAD

| | |
|---|---|
| AutoCAD Autodesk Inc | 2700 |
| ProDesign II, American | 172 |
| In-a-Vision, Microsoft | 237 |
| Generic CAD, Generic | 99 |
| ProDesign II AmericanS&C | 179 |

### Integrated




| | |
|---|---|
| Framework II | 399 |
| Symphony Lotus | 425 |
| 1-2-3 Lotus | 305 |
| Enable, The Software Group | 333 |

### Investment

| | |
|---|---|
| Andrew Tobias's MECA | 115 |
| Dow Jones Market Manager | 147 |
| Dollars and Sense | 107 |
| Market Analyzer Dow Jones | 218 |
| Market Manager Plus, Dow Jones | 129 |
| Spread Sheet Link Dow Jones | 129 |

### Micro-to-Mainframe

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|---|---|
| IRMA Digital Communications | 1429 |
| Crosstalk XVI Microsoft | 119 |

### Outline Processing

| | |
|---|---|
| ThinkTank Living Video | 29 |
| Ready Living Video | 52 |

### Personal Management

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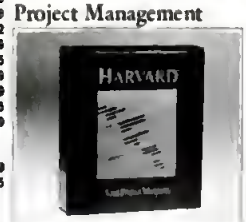
|---|---|
| Andrew Tobias MECA | 115 |
| Dollars and Sense, Mono | 29 |

### Programming Language

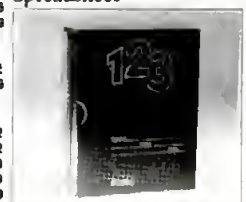
| | |
|---|---|
| Turbo Pascal Borland | 41 |
| C Compiler Microsoft | 287 |
| Basic Compiler Microsoft | 227 |
| Turbo Prolog, Borland | 99 |
| Microsoft Quick Basic | 72 |
| R base System V | 369 |
| Think Tank | 109 |

### Project Management




| | |
|---|---|
| Harvard Software Pub | 399 |
| Microsoft Project | 238 |
| Time Line, Breakthrough | 238 |

### Spreadsheet



| | |
|---|---|
| 1-2-3 Lotus | 305 |
| SuperCalc 3 Computer As | 277 |
| Multiplan Microsoft | 111 |
| Lotus Report Writer | 118 |

### Tax Planning or Preparation

| | |
|---|---|
| Tax Preparer, HowardSoft | 299 |
| PC/TaxCut Best Program | 65 |

### Training

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|---|---|
| Professor Dos, Individual | 35 |
| Teach Yourself dBASE III | 89 |
| PFS First Choice SP | 90 |
| Webster's New Wand Writer | 82 |
| Certificate Maker Springb | 29 |
| Print Shop, Boderbund | 82 |
| Typing Tutor III, Simon & Simon | 42 |

### Utilities

| | |
|---|---|
| Norton Utilities, Norton | 51 |
| SuperKey, Borland | 40 |
| SideKick, Borland | 28 |
| Traveling SideKick | 41 |
| Carbon Copy, Meridian | 120 |
| PC Tool, Central Pnt | 29 |
| Copy II PC, Central Pnt | 30 |
| 1 DIR+ Bourbaki | 53 |
| V Feature, Golden Bow | 29 |
| SQZ! Turner Hall | 99 |
| Fast Back, Fifth Generation | 94 |
| XTree, Executive Systems | 29 |

### Word Processing

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|---|---|
| WordPerfect, Wordperfect | 219 |
| Microsoft Word, Microsoft | 285 |
| Wordstar 2000, MicroPro | 277 |
| Easy, MicroPro | 79 |
| Multimate Advantage, Ashton† | 317 |

### Most Promising Software

| | |
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| Turbo Lightning, Borland | 29 |
| Javelin, Javelin | 549 |
| Microsoft Windows, Microsoft | 28 |
| Q & A, Symantec Corp | 299 |
| Generic CAD, Generic | 29 |

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■ PC LAB NOTES: QuickBASIC FEATURES ■ ETHAN WINER

# A QUICK LOOK AT QUICKBASIC

*BASIC has long been the not-so-royal road to learning programming. A veteran programmer shows why Microsoft's QuickBASIC 2.0 should be the new standard.*

With the release of Version 2 of the QuickBASIC compiler, Microsoft has created their most advanced BASIC ever. Yet for all of its power and speed, QuickBASIC (already affectionately dubbed QB2) is remarkably easy to use. The editor integrated into the package facilitates compiling programs in memory, where they may be tested and run immediately (see accompanying sidebar "Interpreted vs. Compiled BASIC"). The compiler can also be directed to send its output to disk, either as an .OBJ file for separate linking, or as a complete .EXE program.

But the most impressive advances in QuickBASIC over BASICA and earlier versions of the BASCOM compilers are the fundamental additions to the language itself. These are not just a few small improvements—a new dialect, so to speak—but add up to a truly fabulous implementation of the BASIC language. BASIC has always been the easiest language of all to learn, and this latest version includes more features, more raw speed and more power, while making programming easier than ever. In this article, we will look at ways to exploit some of these new functions, and at a few QuickBASIC tips and techniques as well.

In the past, some programmers have criticized BASIC for its lack of "structure," favoring C or Pascal instead. No doubt many dislike it merely because it's so easy to use. After all, if programming a computer can be that easy, then it might lose some of its mystique. But that's exactly my point. BASIC has made programming—real programming—accessible to millions of people. With this latest release, there is no reason to ever apologize for using BASIC.

One of QuickBASIC's strongest points is its support for a modular programming style. True procedures may be created, multiline If/Then/Else blocks are allowed, and line labels instead of numbers are supported. Rather than identifying each line with a number, as in the past, sections of code may be given names. Instead of

```
GOSUB 1200
```

QuickBASIC lets you use

```
Gosub Print.Heading
```

**PRODUCTIVITY INDEX**

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Other improvements QuickBASIC adds to regular BASIC include the abilities to use multiline functions, large arrays and programs (limited only by the PC's memory), long strings, and local variables, plus network and EGA support, and a terrific manual that includes numerous examples. In fact, QuickBASIC can do so many things that regular interpreter BASIC either can't do or is impossibly slow at, that it is sure to become the new standard. And on top of all this, it is readily available by mail for substantially less than its $99 list price. Let's take a closer look.

**MULTILINE FUNCTIONS** It's certainly not difficult to imagine how multiple program lines within a function definition could be useful, but this new form presents other interesting possibilities as well. For example, a function may now actually do something instead of merely calculating a result. Suppose, for example, that a program needs to count the number of lines contained in several different text files. Using this new capability and a few local variables, each file could be examined with a single statement.

```
Line.Count = FnCount(File.Name$)
```

A suitable function definition might be written as shown in Figure 1.

Notice how the assignment of a value to the function name is performed separately, at the end of the definition. (Of course, QuickBASIC also supports the old method of defining functions, as well.)

But even for relatively simple func-

## ■ PC LAB NOTES

tions, this new capability can be a big help. For example, If/Then testing may now be included within a function definition. In the past, the truth of an argument had to be determined by complicated and often devious means. Consider a function that will convert a single letter to uppercase. The old way of doing this would be something like that shown in Figure 2.

In the old method, the "truth of" whether X$ is a valid lowercase letter is first multiplied by 32 and is then added to the original ASCII value of X$. Of course, you would normally *subtract* 32 to convert a character to uppercase. But in BASIC,

■ Program statements in QuickBASIC can be made to continue onto subsequent lines by using an underscore, contributing greatly to readability.

when a condition is true, it results in a *minus* one. Contrast that mess with the equivalent QuickBASIC procedure. First you define the function (see Figure 3). Then, to capitalize a character, you simply invoke the function thus:

```
X$ = FnUp$(X$)
```

Further, since multiple program lines may be used, it's not hard to design a function that capitalizes *all* the letters in a string (see Figure 4).

Notice in Figure 4 how program statements in QuickBASIC can be made to continue onto subsequent lines by using an underscore. This can contribute greatly to a program's readability, which is much of what QuickBASIC is all about. These "logical lines" may be up to 32,767 characters long, though I wouldn't want to write a program that way!

**SUBPROGRAMS** Parameter passing and local variables are powerful features of subprograms. In the past, if you needed to process six different arrays during the course of a program, the same routine would have been needed that many times—coded once for each different array name. Now a single routine can be reused, with the appropriate array specified when it is called. Let's take a closer look at how this works.

```
Def FnCount(F.Name$)
    Static X, X$                        'local variables
    X = 0                               'initialize counter
    Open F.Name$ For Input As #1        'open specified file
       While Not Eof(1)                 'until it ends
          X = X + 1                     'add 1 for each line
          Line Input #1, X$             'go to the next line
       Wend
    Close
    FnCount = X                         'assign the count
End Def
```

**Figure 1:** *A typical QuickBASIC function definition for counting lines in text files.*

```
Def FnUp$(X$)=Chr$(Asc(X$) + 32 * (X$ => "a" And X$ <= "z"))
```

**Figure 2:** *The convoluted function required under old BASIC to convert a letter to uppercase.*

```
Def FnUp$(X$)
    If X$ => "a" And X$ <= "z" Then X$ = Chr$(Asc(X$)-32)
    FnUp$ = X$
End Def
```

**Figure 3:** *The equivalent QuickBASIC function.*

```
Def FnUp2$(X$)
    Static X, Temp$
    For X = 1 To Len(X$)
        Temp$ = Mid$(X$, X, 1)
        If Temp$ => "a" And Temp$ <= "z" Then _
        Mid$(X$, X, 1) = Chr$(Asc(Temp$) - 32)
    Next
    FnUp2$ = X$
End Def
```

**Figure 4:** *A similar QB2 function to uppercase all letters in a string.*

```
Sub Get.Max(Dummy(1), D) Static
    Static X
    D = 0
    For X = LBound(Dummy) To UBound(Dummy)
        If Dummy(X) > D Then D = Dummy(X)
    Next
End Sub
```

**Figure 5:** *Using the new QuickBASIC functions LBound and UBound.*

Subprograms have two important advantages over traditional GOSUB subroutines. One is that a subprogram is executed only when it is actually called. If you've ever received a "Return Without Gosub" error because your main program "fell into" the beginning of a subroutine, you'll appreciate this feature. The second—and more powerful—advantage is that variables and arrays may now be passed to a subprogram by name.

For example, imagine that one of your programs contains six different numeric arrays and that you will need to determine the maximum value that is contained in each. While the subprogram is being writ-

# INTERPRETED VS. COMPILED BASIC

Before high-level languages such as FORTRAN, COBOL, and BASIC were invented, programmers had to communicate with their computers directly in machine language, the computer's native tongue. If you've ever examined the listing for a sophisticated assembly language program, you have some appreciation of what is involved.

But early computers didn't even have assemblers. Thus, besides having to deal with each bit and byte in the computer's memory directly, programming also required using binary numbers instead of more helpful mnemonics, such as CMP, DEC, and MOV. This fact alone accounts for the enormous rise in the popularity of aspirin during the early 1940s and 1950s.

High-level languages were developed to allow programmers to perform complicated tasks using English-like commands. Since computers can *really* understand only strings of binary numbers, however, humanly comprehensible statements such as Print A$ or Y = Sin(X) must be transformed into a series of steps denoted by binary digits. Thus a high-level language is really just a special type of translator. In fact, there are two types of language translators: interpreters and compilers.

**DOS'S INTERPRETER** Even if you've never fired up BASIC, you've actually had contact with an interpreter—the one built into DOS. When you type DIR or FORMAT, for example, DOS compares what you've typed against a list of words it knows. Only then can it decide what you're asking it to do. DOS's interpreter is contained in the program COMMAND.COM.

People who want to learn programming, however, usually begin by using the BASIC interpreter that comes with their PCs. This version of BASIC comprises two parts: a text editor that lets you enter and edit program instructions, and an interpreter that reads those instructions and then performs them. As the program progresses, each command encountered must be examined sequentially and converted into actions that the PC can actually execute. When the interpreter encounters a statement it doesn't understand, you get the all-too-familiar "Syntax error" message.

The important point to realize here is that each of these instructions is translated as the BASIC program is running. This takes time. BASIC maintains a table that contains each and every possible command and punctuation symbol, and it must constantly search through this table to find matches with the sequence of program instructions while the program itself is running. Further, every time you use a variable, another table containing a list of all their names must be searched and updated, as necessary.

For simple programs, this ongoing translation overhead is not a big deal. After all, who out there really cares if it takes one or ten thousandths of a second to perform a calculation? But when many calculations are involved, continually having to decipher each instruction and search for variables can prove to be a real liability. This is where compilers come into the picture.

Unlike an interpreter, a compiler performs its translations all at once, ahead of time. It takes extra time up front—that is, before the program runs—to do this, but when the program is finally executed, it really flies. All of the BASIC commands have been translated into the equivalent machine language instructions, and any refrences to variables have been converted to actual memory addresses.

**COMPILER DISADVANTAGES** There are, however, some disadvantages with many compilers, making them cumbersome to use. Generally, using a compiler means that the program must first be written with a text editor and then saved to disk. Next, the compiler must be started and the name of the source program specified. A lot of time is then spent waiting around for the program to be converted. And don't forget the extra step that is required to link the program with the language's library routines. And, of course, nobody writes a program perfectly the first time either, so you end up editing, saving, compiling, linking, testing, editing, saving, compiling. . . .

This is where QuickBASIC really shines. It provides an environment that is very much like that of an interpreter, yet it creates programs that run like blazes. A program may be edited, compiled, and tested within seconds, without ever having to leave that friendly environment.

**—Ethan Winer**

ten, you would use a "dummy" array name to describe the action the routine will perform. But when the program finally executes, the array that is passed to it will be operated on instead.

You could call the subprogram with

```
Call Get.Max(Array(), Max)
```

where Array( ) is the array to be searched, and Max returns holding the value of its largest element. Since an entire array is being passed to the subprogram, empty parentheses are used, as opposed to a specific element number. Within the subprogram, however, you instead specify the *number of dimensions* contained in the incoming array (see Figure 5).

Notice the new functions LBound and UBound, which return the lower and upper array bounds. The lower will be either 0 or 1, depending on your use of Option Base. The upper will be the size to which the array was originally dimensioned.

Also notice the two different forms of the newly added Static function. When used in conjunction with a subprogram name, Static defines that subprogram as being nonrecursive. (Microsoft states that for now, using Static is mandatory, which implies that they are working on a recursive capability.)

The second use of Static declares a variable to be both local and permanent. Normally, temporary variables are created and discarded at run time as they are needed. Using Static forces space for a variable to

be set aside permanently, which guarantees that it will retain its previous value if the subprogram is reentered later. We don't really care in this example because our X is simply a temporary counter, but for other applications it is important to understand the difference.

Usually, variables in a subprogram (except those passed in the Call) are considered both local and temporary. To share variables between a sub- and a main program without requiring them to be explicitly passed, you would declare them as Shared instead of Static within the subprogram.

**BLOCK-STRUCTURED IF/THEN/ELSE** One of the things I always envied about Pascal was the Begin and End block that could follow an If statement. When a series of steps should be performed if a condition is true, BASIC would require you to say, "If this is *not* true, then skip over the following code." A minor inconvenience maybe, but it doesn't truly reflect the logic of what is happening, which good program code should.

With the block If/Then structure, multiple statements may be executed—spanning many separate lines if you like—and with multiple levels as well. Figure 6 offers a typical example.

To define an If clause as allowing multiple lines, Then must be the last statement on the line, and the end of the block must be marked with an End If. In the example

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# USING METACOMMANDS

Metacommands are instructions to the compiler (as opposed to BASIC commands) that you can place within your program. QuickBASIC currently recognizes three such metacommands, each of which is embedded within a remark and begins with a dollar sign ($). My favorite is $Include, which allows you to merge a previously written section of code into a program when it is compiled. When using the BASIC interpreter, by contrast, if you have created a library of often-used routines, each must be merged manually into the program, and you must be very careful to avoid conflicting line numbers. Of course, with QuickBASIC, line numbers are a thing of the past. But $Include is particularly helpful because it avoids having to merge at all. You just specify the name of the program to bring in, and QuickBASIC does the rest. Here's an example:

```
' Program.Bas - J. Q. Public
  Defint A - Z
  Dim Amount!(1500)
' $Include: 'Averages.Bas'
' $Include: 'ErrHandl.Bas'
' $Include: 'IORoutin.Bas'
  .
  .
  .
  (program continues)
```

Any code in the named files will be read in from disk when the program is compiled. When using $Include, however, you must avoid conflicting variable names or line labels in the included programs. If the main program has a routine named Get.Key, the same label in an included program will cause a conflict. (Remember, the entire program ends up being combined—$Include is merely for your convenience.) Further, if an included routine uses arrays, all relevant Dim statements in the main program must be placed before the $Include is used.

**MORE METACOMMANDS** The two other metacommands—$Static and $Dynamic—tell QuickBASIC how to allocate space for numeric arrays. When $Static is encountered during compilation, QuickBASIC permanently sets aside memory for all subsequent dimensioned arrays. Thus

```
' $Static
Dim Array%(500) 'a permanant array
```

When you use $Dynamic, on the other hand, you tell QuickBASIC that it is to dimension and create numeric arrays at run time as they are needed. Normally, Dim is not an executable command, but rather an instruction to the compiler about how to allocate memory. However, any Dim statements that occur after a $Dynamic metacommand will be executable. Thus

```
' $Dynamic
Dim Array#(350)  'to be created later
```

Although not explicitly stated in the QuickBASIC manual, $Dynamic and $Static may be used freely throughout a program, as various arrays are being defined.—**Ethan Winer**

```
If X$ = "goat cheese" Then
   Print X$
   GC = GC + 1
   If Y$ = "candied yams" Then
      Print Y$
      CY = CY + 1
   Else Print "Sorry, no yams today."
      CY = 0
   End If
Else Print "Goat cheese wasn't found."
   GC = 0
End If
```

**Figure 6:** *Multiline, multilevel If/Then structures are permitted in QB2.*

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■ PC LAB NOTES

# USING ASSEMBLY LANGUAGE WITH QUICKBASIC

BASIC has always allowed access to external routines written in assembly language, but QuickBASIC makes the process easier than ever. Since one of QuickBASIC's most attractive features is its built-in editor, it would have been a serious mistake to require routines to be linked separately. Happily, QuickBASIC permits custom-made user libraries to be created and loaded directly into the editor.

Microsoft provides a special program called BuildLib for this purpose. BuildLib works much like Link, in that it combines one or more .OBJ files into a single .EXE program. In fact, BASIC subprograms may also be included in an external library. (Note, however, that subprograms in a library cannot directly share variables with a main program unless the variables are included as part of the Call command or are declared as Common in both programs.)

One interesting feature of BuildLib that is not mentioned anywhere in the QuickBASIC manuals is that you can use it to combine many more files that can be entered on one line. When you start BuildLib, it prompts you for the names of the files to be placed in the library. At this point, since you're at the mercy of the DOS editor for input, no more than 127 characters may be entered. This proved to be a problem when I was developing my *QuickPak* extensions for QuickBASIC, for I needed to combine more than 20 separate assembly language routines into a single library. Fortunately, there is a simple solution: type a plus sign (+) as the last character in the list. BuildLib will then prompt for additional filenames.

Assembly language routines must be created with the Microsoft (or a compatible) Macro Assembler—DEBUG won't do here. The reason is that MASM allows procedures to be declared as Public, which is an essential part of calling external routines by name.

Another important point for consideration when you are writing assembly language add-ons for QuickBASIC involves the proper storage of constants and variables within the program. Never attempt to use the OFFSET assembler operator to access data embedded within a program. Instead, what you should do is place all of the data items in a group (as shown in the example in Figure A) and use the LEA (Load Effective Address) 8088 instruction.

Many people learn assembly language by beginning with small .COM programs like those frequently printed in books or magazines. MOV OFFSET works just fine in a .COM program, because all of the segments end up being the same. But in a routine intended to be combined with QuickBASIC, data must be kept entirely separate from the code.

In Figure A, the variable Counter and the constant File.Name are both assigned to the Data segment, which is then assigned to the group DGroup. Notice also how both the data and code are declared Public. If these steps are not taken, QuickBASIC won't be able to locate the routines or data when the program finally executes. **—Ethan Winer**

```
Data            Segment Word Public 'Data'
   Counter      DB (?)
   File.Name    DB 'Accounts.Dat', 0
Data            Ends
DGroup          Group Data

Code            Segment Byte Public 'Code'
                Assume  CS:Code, DS:DGroup
                Public  ProgName
ProgName        Proc    Far
                Mov CX, Counter
                Lea DX, File.Name
                .
                .
                .
                (program continues)
```

**Figure A:** *QuickBASIC requires keeping data separate from code.*

above, one If/Then/Else block is nested within another. Of course, the Else is optional. Further nesting is also possible, and in addition, you can make use of an ElseIf statement that will continue the action of a preceding If. For simple tests, the original form of If/Then/Else is still supported.

**LARGE ARRAYS** Yet another feature of QuickBASIC 2.0 is the ability to define large (up to 64K each) numeric arrays. Defining an array as being "large" merely involves declaring it as *Dynamic* (see sidebar "Using Metacommands"). Let's digress for a moment to consider the difference between static and dynamic arrays.

As we saw in the subprogram example, variables that are defined as being static have their space allocated at compile time and are permanently attached to the program. Therefore, when a static array is dimensioned, its size must be stated specifically rather than with a variable. However, a dynamic array is actually created at the time the Dim statement is encountered when the program is run. A general memory pool called the *Far Heap* is used to hold all of these large dynamic arrays.

Two other differences between static and dynamic arrays involve what happens when the Erase and Redim commands are encountered in a program. When a static array is erased, all of its elements are reset to a value of zero, though the space set aside to hold them remains intact. Remember, this space had been permanently reserved when the program was compiled. By contrast, erasing a dynamic array actually releases the memory that held it.

When a dynamic array is redimensioned, it is first erased and then dimensioned again. This causes any values held

in the array to be lost. Of course, static arrays may not be redimensioned.

**LARGE PROGRAMS** Besides accommodating large arrays, compiled programs may also occupy all available memory. The only limitation is that a large program must be composed of smaller modules that have been compiled individually. To create the final program, the modules are linked together. As far as I'm concerned, this is not much of a liability—who wants to sit around waiting for a 450K program to compile for each small change?

The proper way to create very large programs is to first write a series of subprograms, each designed to perform a specific task. Then create a main program that makes calls to the routines in the subprograms. Finally, use Link to combine all of the pieces together.

■ One terrific feature in QuickBASIC is the ability it gives a program to access parameters passed on the DOS command line.

**COMMAND$ AND ENVIRON$** One really terrific feature in QuickBASIC is the ability it gives a program to access parameters passed on the DOS command line. For example, if you have created a program that converts your *WordStar* documents into ASCII format, you might like to call it up like this:

```
CONVERT FILENAME
```

Before QuickBASIC, there was no reasonable way to do this.

The reserved variable Command$ contains any text or instructions that were entered on the same line used to begin the program. All the program would have to do is open the file and begin.

```
File.Name$ = Command$
Open File.Name$ For . . .
```

# STRING HANDLING IN QUICKBASIC

Whenever a string is assigned, BASIC allocates new space for it in the "string pool," even if that string was already defined earlier. It would be too much to expect BASIC to overlay an old string with a newer one in the same space, since the string lengths may have different lengths. Therefore, BASIC doesn't even try. It abandons the old string and puts the new data into the next free space in the string pool. When no more space is available, a clean-up (often called garbage collection) is performed, and any obsolete strings are discarded. Strings that are still active are then moved into adjacent locations in memory, compacting the string pool.

The importance of all this is if the number of new strings can be minimized, BASIC programs will run faster. Assigning new space, adjusting string pointers, and collecting garbage all take time. Let's look at some examples that can affect the way you program.

If several string variables are to be printed in succession, don't use a plus sign as a separator, as in

```
Print X$ + Y$ + Z$
```

While it doesn't appear that a new string is being assigned, BASIC will still combine the strings temporarily before printing them. The result of this concatenation ends up in the string pool. So, although many of the examples in the QuickBASIC manual show a semicolon as a separator, I recommend using a blank space. This creates less clutter and makes the program more readable.

```
Print X$ Y$ Z$
```

One place where you will still need to concatenate is when you open a file whose name is composed of several parts. I've often seen it done this way:

```
F$ = Drive$ + ":" + File.Name$
Open F$ For Input As #1
```

But that extra step really isn't necessary. Instead you could simply write

```
Open Drive$ + ":" + File.Name$ ...
```

Yet another way to avoid unnecessary string assignments is to use the Mid$ statement form whenever possible. For example, if a string is to be built from many data statements, it is frequently done like this:

```
For I = 1 To 100
    Read Byte
    X$ = X$ + Chr$(Byte)
Next
```

It's better to assign X$ once and insert the individual bytes into it, thus:

```
X$ = Space$(100)
For I = 1 To 100
    Read Byte
    Mid$(X$, I, 1) = Chr$(Byte)
Next
```

One final topic on strings in QuickBASIC that is not very well known is the use of back pointers. In the interpreter, garbage collection is an extremely slow process, sometimes taking 5 minutes or more. All of the string descriptors must be searched multiple times in an effort to determine which data is current and where it is located in memory. But in the BASIC compilers, a special pointer—located just before the actual string data—is used to point back to the descriptor to speed up the process. Here's how they are constructed.

Unlike numeric variables and arrays, when you ask QuickBASIC for the Varptr to a string, what it returns is the address of a string descriptor. This descriptor is a two-word (4-byte) table. The first word contains the length of the string and the second holds the address of its first character. Just before that first character is a word that usually contains the address of the original descriptor. (I say usually, because with a null string, the back pointer instead holds the address of a dummy data location.) If you manipulate strings behind BASIC's back—for example, when sorting an array in assembly language—you must deal with these back pointers.—**Ethan Winer**

■ PC LAB NOTES

# A WISH LIST FOR QUICKBASIC 3

One of the biggest hassles BASIC programmers have to face is handling user input. I often use Line Input—even for numbers—just to eliminate the possibility that someone will receive a "redo from start" message. But what is really needed is a means of controlling the length of text being entered. To incorporate this single feature, programmers have to create an elaborate input routine using a loop of Inkey statements. Line Input does so much already, handling such keystrokes as the arrow keys, Ctrl-arrow keys, Ctrl-End, Insert and Delete, etc. If Microsoft would just add an optional length specifier, life would be that much easier. I imagine the syntax being something like this:

```
Line Input X$, 30
```

where 30 is the maximum allowable length before Line Input begins beeping.

Another nice feature would be an expansion of the Option Base parameter. As it is now, the options are either 1 or 0. But if any reasonable base could be specified (as in Pascal), a program could include statements such as

```
Option Base 1980
Dim Sales.Year%(20)
```

It's very difficult to criticize the outstanding error handling QuickBASIC provides while debugging programs. But when an error occurs, a cryptic little box appears with the cryptic message, "Next Error." What's really needed is to explain that F6 is the keystroke that will get you there.

Local variables are great, but the addition of local labels to multiline functions and subprograms would be even greater. You're not supposed to Goto or Gosub in and out of functions and subprograms anyway, and not having to worry about conflicts in $Included programs would be a terrific improvement.

**—Ethan Winer**

```
Poke (Row - 1) * 160 + (Column - 1) * 2, 12
```

**Figure 7:** *Determining the address into which to Poke an otherwise undisplayable ASCII value.*

```
For X = 1 To 500
    If Array$(X) = "Chicken Lips" Goto Found.It
Next
Found.It: Print "Found at location" X
```

**Figure 8:** *Traditional BASIC encourages programmers to use this improper way of exiting a For/Next loop.*

```
If Array$(X) = "Chicken Lips" Then Found = X : X = 500
```

**Figure 9:** *The right way to exit.*

Another related feature that is not present in earlier versions of the BASIC compilers is access to the DOS environment table. For example, if you are creating programs for distribution, you can't always be certain of exactly what kind of system they will be run on. If your program needs a particular data file but can't find it in the current directory, you can use the reserved variable Environ$ to check the PC's current Path before an error is reported.

```
P$ = Environ$("PATH")
```

Of course, it is up to the QuickBASIC program to parse the string that is returned into individual directory names. An example of the kind of data this use of Environ$ might return is shown below.

```
C:\;C:\BASIC;C:\DOS
```

Environ$ can also be used to retrieve the current DOS prompt, the computer's bootup drive, plus any custom environment information that was loaded afterward.

Simlarly, changes may be made to the environment with the Environ statement:

```
Environ "PATH=C:\Utilities"
```

## QUICKBASIC TIPS & TRICKS

■ **Printing the Unprintable** If you've ever tried to print some of the special graphics characters below ASCII 32, you are undoubtedly aware of the strange things that many of them do. For example, Chr$(7) sounds a beep, Chr$(11) homes the cursor, etc. So how can these be printed? It's easy. Instead of using Print, simply Poke the equivalent ASCII value directly into screen memory.

For a monochrome monitor, you first issue a Def Seg = &HB000. (For a color setup or an EGA use &HB800 instead.) The address to Poke can then be calculated from the desired screen coordinates. To put a Chr$(12) on the screen at a particular row and column, you can determine the address with the formula in Figure 7. Incidentally, the old trick of poking a character into the screen at row 25, column 80, to prevent scrolling is no longer necessary. QuickBASIC takes care of this problem by itself.

■ **For Without the Next** One of the biggest mistakes a BASIC programmer can make is to exit a For/Next loop unresolved, as in Figure 8. Yes, this procedure may work for a while, but do it enough times and it's bound to cause a crash. If you must exit a loop prematurely, always set the counter to the maximum originally specified, as in the case, for example, in Figure 9. This will satisfy the loop and end the search at the same time, but without clobbering the stack. The same is true for subroutines, functions, and subprograms. *Never* exit one of these with a Goto. To jump out of a subroutine, use Return Line Number or Line Label. And use Exit Def and Exit Sub to leave functions and subprograms.

■ **Hung Up?** Until Microsoft gets around to recognizing that there are other programs in the world, *SideKick* users may find this tip helpful. If your PC locks up

## ■ PC LAB NOTES

because you tried to use *SideKick* or *SuperKey* from the QuickBASIC editor, don't immediately reach for the big red switch. Instead, regain control by first pressing Alt-F and then Ctrl-PgUp.

■ **Running Other Programs** The last trick that we'll consider solves a long-standing problem for BASIC programmers. Sometimes it is necessary to run another program or batch file directly from a BASIC program—as, for example, when writing a DOS menu system. The Run command will work, but only if the program to be executed is also written in BASIC or is another .EXE program. Of course, you could always use Shell, but that takes extra memory away from the system because the BASIC program is still resident. Further, Shell causes a second copy of COMMAND.COM to be loaded, which steals even more memory.

In retrospect, the solution is painfully obvious: Start the BASIC program from a batch file. Then, within the program, open that same batch file for Append and write any statements to be executed at the end of the file. When your program ends, the batch file will still be pending and the additional commands will then be processed!

There is only one thing to be aware of when using this technique. Make sure there is a final Enter after the name of the BASIC program in the batch file when you create it. Many programmers like to press Ctrl-Z at the end of the line that holds the last command to eliminate the double prompt that occurs when a batch file ends.

**ALMOST PERFECT** There are many wonderful features in Version 2.0 of QuickBASIC, but there are some minor flaws, too.

My biggest gripe is with the way Microsoft chose to access the keyboard in the editor. Rather than follow Microsoft's own rules about using the BIOS, the editor goes directly to the hardware ports for input. This would not be a problem in itself had they been properly chained to existing keyboard software. As it is, *SideKick* and *SuperKey* (and I assume *ProKey* and similar programs) either don't work correctly or completely hang the system. In fact, just having other keyboard handlers resident in memory precludes being able to use the step/trace debug feature in QuickBASIC. On my standard PC it causes a total crash that requires a power off reboot.

Another minor complaint is that the Delete Key does not always work as expected. While a program is being edited, it works just fine. But for some reason, you are expected to use Shift-Backspace instead of Delete when editing the name of a program to load or save.

Further, QuickBASIC provides no overstrike mode. The editor can only insert text. For all of the work that obviously went into designing QuickBASIC, I find it incomprehensible that Microsoft could have omitted this essential feature.

My final objection is the use of a nonintuitive method for selecting choices from some of the menus. The Tab key is used to navigate between selections, but you must then use the *space bar* to accept it. Pressing Enter will select a choice all right, but not necessarily the one that is highlighted.

■ QuickBASIC's editor is extremely fast and uses a wonderful system for marking blocks of text.

You'll notice that nearly all of these complaints center around the QuickBASIC editor. Programmers don't merely *use* an editor—they have a relationship with it. My preferences aside, the QuickBASIC editor is extremely fast, and it uses a wonderful system for marking blocks of text. And rather than give the wrong impression, let me also point out that overall I genuinely like QuickBASIC's editor. It has many useful features, supports a mouse, handles wide lines with horizontal scrolling, and much more.

In sum, then, QuickBASIC is an outstanding product with a more than reasonable price. If you are serious about programming in BASIC and don't already own a copy, my advice is simple: buy it!

*Ethan Winer, an independent consultant, is the head of Crescent Software in East Norwalk, Connecticut.*


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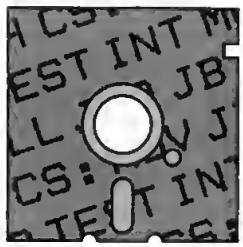

*DOS file management techniques are an exercise in tedium. DIREX lets you race through your file copying, deleting, protecting, and unprotecting chores.*

Like many power users, I'm a file litterbug. As I work, I leave a trail of files across diskette after diskette, rushing headlong toward full directories and packed allocation tables. And, of course, I get infuriated when I get the message "Insufficient disk space."

The fact is that when it comes to directory cleanup and management, DOS is not very helpful. After piling up a solid day's worth of files, deleting is a tedious business. You type DIR and watch the files crawl up the screen. A quick ^C stops the scroll, but if you haven't given all your scratch files a common extension (do *you* remember to?) you're stuck with the usual DEL LONGNAME.FIL, time after time. Then another screenful of DIR entries, while your inspiration and time ebb away.

**SIMPLER FILE MANAGEMENT** I wrote DIREX to simplify managing large numbers of files in multiple directories. Unlike most similar programs, it's short (1.8K) and fast, and in addition to letting you copy or delete groups of files, it can protect and unprotect them, as well. You can enter the program with any of the following kinds of commands:

```
DIREX
DIREX A:
DIREX A:\
DIREX B:*.BAS
DIREX C:\UNDER
DIREX C:\UNDER\UNDER1
DIREX C:\UNDER\*.BAS
```

The directory's files come up on the screen, six across. DIREX can display only one screenful of files, so it shows only the first 120, but since you can restrict the listing with wildcards, I've found that's enough.

You move the reverse video cursor around with the cursor keys until the file you want to work on is lit up. To mark it for further action, just press the SpaceBar; should you make a mistake, hitting the SpaceBar a second time unmarks the file. Marked files remain illuminated in reverse video when you move the cursor away, and you can select as many files at once as you want.

After you've marked the file(s) you want to work on, you have four options. You can (P)rotect, (U)nprotect, (D)elete, or (C)opy them just by typing the single

```
        TARGET EQU 0D0H
        SOURCE EQU 0B0H
CODE_SEG        SEGMENT
        ASSUME  CS:CODE_SEG,DS:CODE_SEG,ES:CODE_SEG
        ORG     100H
START:  JMP     DIREX
        PROMPT DB 'D=Delete P=Protect U=Unprotect C=Copy <Space>=Mark'
               DB ' N=New Dir Q=Quit$'
        COPY_PROMPT     DB      'Pathname to copy marked files to: $'
        NEW_DIR_PROMPT  DB      'New Pathname: $'
        FULL_MSG        DB      '*         TARGET DISK FULL!          *$'
        DEL_MSG         DB      'Delete Marked Files (Y/N)? $'
        COPY_FLAG       DB      0       ;Set when doing copies.
        D1_FLAG         DB      0       ;In DISPLAY, not DSPLAY@
        DISP_FLAG       DB      0       ;Set when initel display done.
        FULL_FLAG       DB      0       ;Disk Full Flag.
        NOFILE_FLAG     DB      0       ;1-->No filename given.
        SOURCE_HANDLE   DW      0       ;Source File Handle.
        TARGET_HANDLE   DW      0       ;Target File Handle.
        SOURCE_PATH_END DW      0B0H    ;End of Path -- put filenames here.
        TARGET_PATH_END DW      0D0H    ;Same for Target.
        TEST_PATH_END   DW      0       ;Same for Target.
        BYTES_READ      DW      ?       ;Bytes read -- for copy.
        BYTES_ASKED     DW      ?       ;Bytes requested to be read.
        MARKED  DB      ?               ;File Marked?
        ATTRIB  DB      7               ;Screen Attribute.
        WILDCARDS       DB      '*.*',0
        CURSOR_X        DB      ?       ;Reverse Vid. Cursor position X
        CURSOR_Y        DB      ?       ;Same for Y.
        TEMPX           DB      ?       ;Temporary storage for x,y positions.
        TEMPY           DB      ?
        FILENAME        DB      10 DUP(0)       ;Store given filname here.
                        DB  "Copyright 1986 Ziff-Davis Publishing Co.",1Ah
                        DB  "Programmed by Steven Holzner",1Ah


DIREX   PROC    NEAR
        CALL    DISPLAY                 ;Setup -- put dir on screen.
        MOV     SI,SOURCE_PATH_END      ;Light up first filename.
        CALL    GET_FILE_NAME
TOPPER: MOV     ATTRIB,70H
        CALL    COLOR
TOP:    MOV     AH,0                    ;Read a character w/o echo.
        INT     16H                                          (continues)
```

**Figure 1:** *The assembly language listing for DIREX.COM.*

letter corresponding to each command. If you type C, for example, a prompt will appear to ask for the destination pathname. Thus, to copy the marked files to C:\DUNGEON, you would simply enter either C:\DUNGEON or C:\DUNGEON\. DIREX then copies the marked files, from left to right, first line on the screen to last line, to their destination. The regular blinking cursor is successively positioned at each marked file so you can follow the copying process.

After you've copied your files, you might want to check the target subdirectory to see that they're all there. You can change directories in DIREX just by typing N—for (N)ew pathname—and you can again restrict the entries it presents for your further action by entering, for example, D:\UNDER*.BAS.

■ To clean up your directories, you'll simply mark the files you want to trash and select the D (delete) option. A confirmation prompt is included.

To clean up your directories, you'll simply mark the files you want to trash and select the D (delete) option. A confirmation prompt asking whether or not you really do want to delete the marked files is included for safety.

The other available DIREX option is protecting or unprotecting marked files. If a file is marked read-only, it cannot be deleted or rewritten unless, of course, you first change its protected status. DIREX lets you protect or unprotect whole groups of files at once. Just mark the files you want to set to read-only and press P. To unprotect them, use U.

A prompt line in DIREX lists all the options and what they do, so you don't have to remember these commands.

```
SPACE:  CMP     AL,20H                  ;Space? Mark a file?
        JNE     RIGST                   ;No, check cursor keys
        MOV     AH,8                    ;Yes.
        MOV     BX,0                    ;Check if file marked.
        ADD     CURSOR_X,12             ;Read byte just after filname
        CALL    SET_CURSOR              ; from the screen.
        INT     10H
        CMP     AL,0FFH                 ;Marked? (Yes if FFH)
        JE      OPP                     ;Yes.
        MOV     AL,0FFH                 ;No, mark.
        JMP     PPO
OPP:    MOV     AL,0                    ;Unmark, move 0 to last byte.
PPO:    MOV     AH,10
        MOV     CX,1
        INT     10H
        SUB     CURSOR_X,12             ;Reset cursor to beginning of filename.
        CALL    SET_CURSOR
        JMP     TOP                     ;And start over.

RIGHT:  CMP     AH,4DH                  ;Right cursor key?
        JNE     LEFT                    ;No, try left.
        MOV     ATTRIB,7                ;Unmark current file if we can.
        CALL    COLOR
        CALL    INC_CURSOR              ;Move to next filename.
        MOV     ATTRIB,70H
        CALL    COLOR                   ;And highlight it.
        JMP     TOP                     ;Start over.

LEFT:   CMP     AH,4BH                  ;Left cursor key?
        JNE     UP                      ;No, try up key.
        MOV     DL,CURSOR_X             ;Yes, move one filename left.
        MOV     DH,CURSOR_Y
        MOV     ATTRIB,7                ;First unmark current filename.
        CALL    COLOR
        SUB     DL,13
        JNC     OK                      ;Can we move left?
        MOV     DL,5*13                 ;No, wrap back.
        SUB     DH,1
        JNC     OK                      ;Make sure not over top of screen.
        MOV     DL,CURSOR_X             ;If so, do not change marked file.
        MOV     DH,CURSOR_Y
OK:     MOV     CURSOR_X,DL
        MOV     CURSOR_Y,DH             ;Load changed cursor positions
        CALL    SET_CURSOR              ; and light up new filename.
        MOV     ATTRIB,70H
        CALL    COLOR
        JMP     TOP                     ;And start over.

UP:     CMP     AH,48H                  ;An Up key?
        JNE     DOWN                    ;No, try down.
        MOV     DL,CURSOR_X             ;Yes, get highlit position.
        MOV     DH,CURSOR_Y
        MOV     ATTRIB,7                ;Unmark current filename.
        CALL    COLOR
        SUB     DH,1                    ;Can we go up?
        JNC     NOTTOP                  ;Yes.
        ADD     DH,1                    ;No.
NOTTOP: MOV     CURSOR_X,DL             ;Set new cursor position.
        MOV     CURSOR_Y,DH
        CALL    SET_CURSOR
        MOV     ATTRIB,70H              ;And highlight new filename.
        CALL    COLOR
        JMP     TOP                     ;And start over.
DOWN:   CMP     AH,50H                  ;Was this a down cursor key?
        JNE     LETTERS                 ;No, try letters (C,N,D,U,P)
        MOV     ATTRIB,7                ;Yes, unmark current filename.
        CALL    COLOR
        INC     CURSOR_Y                ;Are we past bottom if we INC Y?
        CALL    SET_CURSOR
        MOV     SI,SOURCE_PATH_END
        CALL    GET_FILE_NAME
        CMP     BYTE PTR DS:[SI],' '    ;Is there a filename there?
        JA      GO                      ;If yes, go.
NOGO:   DEC     CURSOR_Y                ;If no, retain old position.
        CALL    SET_CURSOR
GO:     MOV     ATTRIB,70H
        CALL    COLOR                   ;Highlight this file.
        JMP     TOP

LETTERS:CMP     AL,'a'                  ;Convert to lower case
        JL      GOL
        SUB     AL,'a'-'A'
GOL:    CMP     AL,'Q'                  ;Is this a 'Q' to quit?
        JNE     DEL                     ;No, try 'D'.
        MOV     CX,25                   ;Clear the screen.
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,0
        CALL    SET_CURSOR
```

*(Figure 1 continues)*

```
WIPE2:  PUSH    CX
        CALL    HET_CURSOR
        MOV     CX,80
        MOV     AH,9                    ;Use Service 9
        MOV     BX,7
        MOV     AL,0
        INT     10H                     ;With INT 10H.
        POP     CX
        INC     CURSOR_Y                ;Keep going on this line.
        LOOP    WIPE2                   ;Loop over all 25 lines.
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,0
        CALL    SET_CURSOR
        JMP     OUT                     ;Quit.

DEL:    CMP     AL,'D'                  ;Is this a 'D'?
        JE      OKD                     ;Yes.
        JMP     PRO                     ;No, Try 'P'.
OKD:    MOV     ATTRIB,7
        CALL    CULOR                   ;Unhighlight current filename.
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,24
        CALL    SET_CURSOR              ;Reset cursor to beginning.
        MOV     AH,9
        MOV     CX,80                   ;Print Del prompt.
        MOV     AL,' '                  ;First, clear prompt line.
        MOV     BH,7
        INT     10H
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,24
        CALL    SET_CURSOR
        MOV     AH,9
        MOV     DX,OFFSET DEL_MSG
        INT     21H
        MOV     AH,1                    ;Get a response.
        INT     21H                     ;Convert to upper case.
        CMP     AL,'Z'
        JL      CHECKY
        SUB     AL,'a'-'A'
CHECKY: CMP     AL,'Y'                  ;Was this a 'Y'?
        JE      GODEL                   ;Yes, Delete!
        CALL    DSPLAY2                 ;No, highlight current file and
        MOV     ATTRIB,70H              ; start over.
        CALL    CULOR
        JMP     TOP
GODEL:  MOV     CURSOR_X,0              ;Delete here.
        MOV     CURSOR_Y,0              ;Start at beginning.
        CALL    SET_CURSOR
LOOPD:  CALL    GET_MARKED_FILE         ;Loop over all marked files.
        MOV     DX,SOURCE               ;Point to source string.
        MOV     AH,41H                  ;Delete!
        INT     21H
        CALL    INC_CURSOR              ;Move to next file.
        CMP     DH,0FFH                 ;Is there one?
        JE      FIND                    ;Yes.
        CMP     CX,0FFH                 ;No, start over, refresh display.
        JNE     LOOPD
FIND:   CALL    DSPLAY2
        MOV     ATTRIB,70H              ;Highlight first file.
        CALL    CULOR
        JMP     TOP
PRO:    CMP     AL,'P'                  ;Is this a 'P'?
        JNE     UNPRO                   ;No, try 'U'.
        MOV     ATTRIB,7                ;Yes, Unhighlight current file.
        CALL    COLOR
        MOV     CURSOR_X,0              ;Start at beginning of all files.
        MOV     CURSOR_Y,0
        CALL    SET_CURSOR
LOOPP:  CALL    GET_MARKED_FILE         ;Loop over all marked files.
        MOV     DX,SOURCE
        MOV     AH,43H                  ;And Protect them.
        MOV     AL,01
        MOV     CX,1
        INT     21H
        CALL    INC_CURSOR              ;Move on to next filename.
        CMP     DX,0FFH                 ;If there is one.
        JE      FINP                    ;If not, leave.
        CMP     CX,0FFH
        JNE     LOOPP                   ;If so, loop again.
FINP:   CALL    DSPLAY2                 ;Refresh screen.
        MOV     ATTRIB,70H              ;And highlight the first filename.
        CALL    CULOR
        JMP     TOP                     ;And start over.
UNPRO:  CMP     AL,'U'                  ;Was this a 'U'?
        JNE     COPY                    ;No, try 'C' for Copy.
        MOV     ATTRIB,7                ;Yes, unhighlight current file.
        CALL    CULOR
        MOV     CURSOR_X,0              ;Start at beginning of all files.
        MOV     CURSOR_Y,0
```

*(Figure 1 continues)*


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CIRCLE 481 ON READER SERVICE CARD

## ■ PROGRAMMING/UTILITIES

**DIALING UP DIREX** The easiest way to obtain a copy of DIREX is to download it via modem from the PC Magazine Interactive Reader Service, as explained in the accompanying sidebar. If you wish to type it in yourself, however, the assembly language listing is shown in Figure 1, and a BASIC program that will create DIREX.COM when you run it once is contained in Figure 2. The assembler code is adequately commented so far as following the step-by-step operation of the program is concerned. To understand more broadly how DIREX works, let's take a quick tour through the DOS directory system.

■ No matter what disk you have—floppy, 1.2-meg floppy, or hard disk—the DOS directory entries are all exactly the same size: 32 bytes.

**DOS DIRECTORIES** No matter what type of disk you have installed—floppy, 1.2-meg floppy, or hard disk—the DOS directory entries are all exactly the same size: 32 bytes. A conventional 360K floppy allocates 7 sectors (each 512 bytes) on the diskette for the directory. This means that you can have (7×512)/32=112 directory entries in the diskette root directory. (Some of these, of course, could be subdirectories with other files of their own that would extend the tree structure). A 1.2-meg floppy allocates 14 sectors for the directory, so it can hold up to 224 filenames in the root directory. On hard disks, while the number of possible entries varies as you assign the DOS partition more or less space, if you give the entire disk to DOS, it allocates 32 sectors to the root directory, yielding (32×512)/32=512 possible entries.

A file's 32-byte directory entry is broken down thus:

■ Bytes 0–7. These 8 bytes hold the file's name, which is padded with spaces to the

```
        CALL    SET_CORSOR
LOOPU:  CALL    GET_MARKED_FILE         ;Loop over all marked filee.
        MOV     DX,SOURCE               ;Point to found file.
        MOV     AH,43H                  ;And Unprotect it.
        MOV     AL,01
        MOV     CX,0                    ;CX=0 --> Dnprotect.
        INT     21H
        CALL    INC_CURSOR              ;Point to next filename.
        CMP     DX,0FFH                 ;If there ie one.
        JE      FINU                    ;If not, refresh screen and etert over.
        CMP     CX,0FFH
        JNE     LOOPU
FINU:   CALL    DSPLAY2                 ;Refreeh screen.
        MOV     ATTRIB,70H              ;Highlight firet file.
        CALL    COLOR                   ;And etert over.
        JMP     TOP
COPY:   CMP     AL,'C'                  ;Wee thie a 'C'?
        JE      GOC                     ;Yee, Copy!
        JMP     NEW_DIR                 ;No, try 'N' for New directory.
GOC:    MOV     FULL_FLAG,0             ;Set Diek full flag to falee.
        MOV     ATTRIB,7                ;Unhighlight current file
        CALL    COLOR                   ; if we can.
        MOV     CURSOR_X,0              ;Type out copy prompt.
        MOV     CORSOR_Y,24
        CALL    SET_CORSOR              ;First, clear prompt line.
        MOV     AH,9
        MOV     CX,80
        MOV     AL,' '
        MOV     BX,7
        INT     10H
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,24             ;Type out copy prompt.
        CALL    SET_CURSOE
        MOV     AH,9                    ;With the string printing eervice.
        MOV     DX,OFFSET COPY_PROMPT   ;Ask for new pathname.
        INT     21H
        MOV     AR,0AH                  ;Put it at TARGET loeetion.
        MOV     BX,TARGET-2             ;With a buffered read-in.
        MOV     DX,TARGET-2
        MOV     BYTE PTR [EX],32        ;32 bytee max.
        INT     21H
        MOV     BI,TARGET               ;Check now for final '\'.
TRANS:  CMP     BYTE PTR [6I],13        ;If it ie mieeing, put it in.
        JE      SLASH2
        INC     SI
        JMP     TRANS
SLASH2: CMP     BYTE PTR [SI-1],'\'     ;Waa a '\' at tha end?
        JE      FILER2                  ;Yee.
        MOV     BYTE PTR [SI],'\'       ;Put '\' in et end of pathname.
        INC     SI
FILER2: MOV     TARGET_PATH_END,6I      ;Etore end of pathname so we
        MOV     ATTRIB,7                ; cao put filenamee at end of it.
        CALL    COLOR                   ;Dnhighlight current file if we can.
        MOV     CURSOR_X,0
        MOV     CORSOR_Y,0
        CALL    SET_CORSOE
LCOPC:  MOV     COPY_FLAG,1             ;Set Copy fleg [so GET_MARKED_FILE
        CALL    GET_MARKED_FILE         ; will fill in TARGET too).
        MOV     COPY_FLAG,0             ;Loop over all marked files.
        CMP     CX,0FFH                 ;If there are any.
        JNE     OPEN
        JMP     FINC
OPEN:   MOV     DX,SOURCE               ;Now to open source and target.
        MOV     AX,3D00E
        INT     21E
        JC      EOTC                    ;Dnleee there ie an error.
        MOV     SOURCE_HANDLE,AX        ;Open source, etore handle.
        MOV     DX,TARGET               ;Open target.
        MOV     AH,3CE
        MOV     CX,0
        INT     21E
        JC      EOTC
        MOV     TARGET_EANDLE,AX        ;And etore ite haodle too.
STUFF:  MOV     DX,OFFSET DATA          ;We will use the end of the prog
        MOV     CX,62*1024              ; for date. 62K et ooce.
        MOV     AH,3FH                  ;Prepere to reed in ae much as we can.
        MOV     HX,SOURCE_HANDLE        ;Prom the source.
        INT     21E
        MOV     BYTES_READ,AX           ;Bow much was ectually reed?
        MOV     CX,AX                   ;Put # bytee read into CX for write.
        MOV     BYTES_ASKED,CX          ;Store to check leter.
        MOV     AH,40E                  ;Bere'e the write!
        MOV     BX,TARGET_HANDLX        ;Get target handle.
        MOV     DX,OFFSET DATA          ;Point DS:DX.
        INT     21E
```

*(Figure 1 continues)*

```
        CMP     AX,BYTES_ASKED          ;Hee if bytes written sgrees with what
        JNE     FULL                    ; what wse esked. If not, full diek.
        CMP     BYTES_READ,62*1024      ;If OK, did we ectually get 62K?
        JE      STUFF                   ;If so, go back for more.
        JMP     BOTC                    ;If not, done with thie file, close.
FULL:   MOV     CURSOR_X,0              ;Here the disk is full, put up message.
        MOV     CURSOR_Y,24
        CALL    SET_CURSOR
        LEA     DX,FULL_MSG
        MOV     AH,9
        INT     21H
        MOV     FULL_FLAG,1             ;Close files, eet flsg so we can delete
        MOV     CURSOR_X,0              ; partielly copied file in Terget.
        MOV     CURSOR_Y,0
        CALL    SET_CURSOR              ;Move cursor back to top.
EOTC:   MOV     AH,3EH                  ;Close files.
        MOV     BX,SOURCE_HANDLX
        INT     21H
        MOV     AH,3EH                  ;Using Xervice 3EH.
        MOV     BX,TARGET_HANDLE
        INT     21H
        CMP     FULL_FLAG,1             ;Wss this s diek-full csse?
        JNE     NOTFULL                 ;No, do snother file.
        MOV     DX,YARGET               ;Yes, now thst files sre closed, delete
        MOV     AH,41H                  ; partielly copied file in target
        INT     21H                     ; pathname.
        JMP     TOPPER                  ;Go back to top but don't wipa out Oiek
NOTFULL:CALL    INC_CURSOR              ; Pull meesage.
        CMP     OX,0FFH                 ;Point to next file if there ie one.
        JE      FINC                    ;There isn't, finish up copy.
        JMP     LOOPC                   ;There is, stsrt next copy.
FINC;   CALL    DSPLAY2                 ;Refreeh ecreen.
        MOV     ATTRIB,70H              ;Highlight firet file.
        CALL    COLOR
        JMP     TOP                     ;And etert over.
NEW_DIR:CMP     AL,'N'                  ;Wss thie s 'N'? New Oir?
        JX      GON                     ;Yes.
        JMP     TOP                     ;No, ignore whatever wss typad.
GON:    MOV     ATTRIB,7                ;Unhighlight current filename
        CALL    COLOR                   ; if we can (cen't if marked).
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,24
        CALL    XET_CURSOR              ;Get set for 'New Dir: ' prompt.
        MOV     AH,9                    ;Use String Print Service.
        MOV     CX,80                   ;First clesr prompt line.
        MOV     AL,' '
        MOV     BX,7
        INT     10H                     ;Using INT 10H.
        MOV     CURSOR_X,0
        MOV     CURSOR_Y,24
        CALL    SET_CURSOR
        MOV     AH,9                    ;Print out New Dir prompt bere.
        MOV     DX,OFFSET NEW_DIR_PROMPT
        INT     21H
        MOV     AH,0AH                  ;Now use buffered input to beginning
        MOV     BX,80H                  ; of DTA (where the first pathname
        MOV     DX,80H                  ; went anyway).
        MOV     BYTX PTR [BX],32        ;32 bytee max.
        INT     21H
        JMP     OIREX                   ;And start ALL over.
OUT:    INT     20H                     ;Pinish for 'Q'.
DIREX   ENDP

GET_MARKED_FILE PROC    NEAR    ;Thie sete up SOURCE and TARGET.
        ;CX=FF --> No more to be found.
BEGI:   MOV     AH,8            ;Prepare to reed mark byte from ecreen.
        ADD     CURSOR_X,12     ;Right after the filename -- in ecreen
        CALL    XET_CURSOR      ; buffer!
        MOV     BX,0
        INT     10e             ;Reed mark byte.
        SUB     CURSOR_X,12     ;And immedietely reeet cursor.
        CALL    SET_CURSOR
        CMP     AL,0FFH         ;Is thie file marked?
        JX      FIRI            ;Yee, have found it, return.
        CALL    INC_CURSOR      ;No, check next file.
        CMP     DX,0FFH         ;Any more files left to check?
        JNE     BEGI            ;Yee, loop sgain.
        MOV     CX,0FFH         ;No, no more to be found, set the fleg.
        JMP     OUTER           ;And exit.
FINI;   MOV     CX,0            ;Set CX=0 --> more available.
        MOV     SI,SOURCE_PATH_END
        CALL    GET_FILE_NAME   ;Set up SOURCE.
        CMP     COPY_FLAG,1     ;Ie thie s copy? Should we set up TARGET too?
        JNX     OUTER           ;Ro.
        MOV     SI,TARGET_PATH_END  ;Yee.
        CALL    GET_FILE_NAME
```

*(Figure 1 continues)*


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right if needed. If the file was DEBUG.COM, this space would hold "DEBUG". That is, byte 0 holds the ASCII code for "D", byte 1 the ASCII code for "E" and so on.

■ Bytes 8–10. Filename extension. For DEBUG.COM, these bytes would hold the three ASCII bytes "COM".

■ Byte 11. This byte holds the file's attribute. For example, a 1 here means the file is set for read-only. An 8 means the filename and extension—all 11 characters—are the disk's volume label. A 10 here means that the filename is the name of a subdirectory.

■ While the directory entry lets you know where the file *starts*, you need to use the file allocation table to string together the successive pieces.

The names of the files in the subdirectory A:\ARCHIVE are stored in a file named ARCHIVE. In the file allocation table (FAT), the file ARCHIVE is then allotted a number of bytes equal to the total length of the files that comprise the subdirectory. The file allocation table maps the file, piece by piece, to the disk. While the directory entry lets you know where the file *starts*, you need to use the file allocation table to string together the successive pieces. (This is because when the file was initially written, DOS took the first available spaces on the disk, which are not necessarily contiguous.) The file allocation table is stored on the disk just before the directory itself.

■ Bytes 12–21 are reserved by DOS for future expansion.

■ Bytes 22–23 hold the time the file was last written to.

■ Bytes 24–25 hold the corresponding date.

```
OUTER:  RET                     ;And return.
GET_MARKED_FILE ENDP

GET_FILE_NAME   PROC    NEAR
        ;Call with DS:SI as address to put filename at.
        PUSH    CX              ;Push what is used.
        PUSH    SI
        PUSH    WORD PTR CURSOR_X
        MOV     AH,8            ;Prepare to read from screen.
        MOV     BX,0
        MOV     CX,12           ;Twelve possible letters.
LOOPB:  MOV     AH,8            ;Loop and read 'em.
        INT     10H
        INC     CURSOR_X        ;Move to next screen position.
        CALL    SET_CURSOR
        MOV     DS:[SI],AL      ;Store this byte at location we are supposed
        INC     SI              ; to build filename at.
        LOOP    LOOPB           ;Loop again until done.
        MOV     BYTE PTR DS:[SI],0      ;Make it an ASCIIZ string.
        POP     WORD PTR CURSOR_X       ;And now restore all.
        POP     SI
        CALL    SET_CURSOR
        POP     CX
        RET                     ;Return to calling program.
GET_FILE_NAME   ENDP

COLOR   PROC    NEAR            ;Highlights and Unhighlights filenames.
        PUSH    CX              ;If file is marked, will NOT Unhighlight.
        PUSH    WORD PTR CURSOR_X
        MOV     CX,12           ;Twelve characters in filename.
        CMP     ATTRIB,7        ;Are we unmarking?
        JNB     HERE            ;No.
        MOV     AH,8            ;Yes, check if file is marked.
        ADD     CURSOR_X,12     ;Need in mark byte from screen directly.
        CALL    SET_CURSOR
        MOV     BX,0
        INT     10H
        SUB     CURSOR_X,12     ;And reset cursor at once.
        CALL    SET_CURSOR
        CMP     AL,0FFH         ;Was this a marked file?
        JE      FINS            ;Yes, leave w/o unmarking.
HERE:   MOV     BX,0            ;No, move new ATTRIB into place.
        MOV     AH,8            ;Prepare to write to screen.
        INT     10H
        PUSH    CX
        MOV     CX,1
        MOV     BL,ATTRIB       ;Write with attribute ATTRIB.
        MOV     AH,9            ;With Service 9.
        INT     10H
        POP     CX
        INC     CURSOR_X        ;Move on to next letter.
        CALL    SET_CURSOR
        LOOP    HERE            ;And go back until we're done.
FINS:   POP     WORD PTR CURSOR_X
        CALL    SET_CURSOR      ;Finish and return.
        POP     CX
        RET
COLOR   ENDP

DISPLAY PROC    NEAR            ;Puts filenames on the screen.
        MOV     DI,SOURCE       ;Was a pathname specified originally?
        MOV     DI_FLAG,1
        MOV     SI,82H
        MOV     SOURCE_PATH_END,SOURCE
        MOV     BX,80H
        CMP     BYTE PTR [BX],0 ;Not if this byte is a 0.
        JE      DSPLAY2         ;No need to check on '\'.
TRANS2: CMP     BYTE PTR [SI],13        ;Make this an ASCIIZ string.
        JE      PUT0
        MOVSB                           ;Transfer byte by byte to SOURCE.
        CMP     BYTE PTR [SI-1],'\'     ;Is this the end of a pathname?
        JE      STOR                    ;Yes, mark position.
        CMP     BYTE PTR [SI-1],':'     ;Is this a ":" -- also end of pathname.
        JNE     TRANS2                  ;No, keep checking.
STOR:   MOV     SOURCE_PATH_END,DI      ;Store end of pathname here.

        PUSH    SI                      ;POSSIBLE end of pathname discovered.
        PUSH    DI                      ;Save the "filename" that comes after.
        LEA     DI,FILENAME
        MOV     CX,10                   ;First clear the storage area.
        MOV     AL,0                    ;With 0s.
REP     STOSB
        LEA     DI,FILENAME             ;SI is already set.
        MOV     CX,9                    ;Transfer from [SI] to [DI].
ONEBY:  CMP     BYTE PTR [SI],13        ;End of "filename"?
```

*(Figure 1 continues)*

```
        JNE     MOVE                    ;No, move thie byte too.
        MOV     BYTE PTR [DI],0         ;Yee, make FILENAME ASCIIZ.
        JMP     SHORT FIN0
MOVE:   MOVSB                           ;Trenefer 1 byte.
        LOOP    ONEBY                   ;And keep going until "filename" done.
FIN0:   POP     DI
        POP     SI                      ;Reetore SI and DI.

        JMP     TRANS2
PUT0:   MOV     BYTE PTR [DI],0         ;Put the 0 in ASCIIZ.
        MOV     TEST_PATH_END,DI        ;Save thie in caee no filename given.

        MOV     NOFILE_FLAG,0           ;For DISPLAY, set NOFILE_FLAG to 0.
        JMP     CHKFIL
DSPLAY2:MOV     D1_FLAG,0               ;Set D1_FLAG.
        CMP     FILENAME,0              ;=0 if no filename given.
        JNE     CHKFIL
        MOV     NOFILE_FLAG,1           ;Set NOFILE_FLAG.

CHKFIL: MOV     CX,25                   ; can put other filenamee et end.
        MOV     CURSOR_X,0              ;Start at beginning of ecreen.
        MOV     CURSOR_Y,0
        CALL    SET_CURSOR              ;Set cursor to match.
WIPE:   PUSH    CX                      ;Wipe the ecreen.
        CALL    SET_CURSOR
        MOV     CX,80
        MOV     AH,9                    ;Uee Service 9
        MOV     BX,7
        MOV     AL,0
        INT     10H                     ;With INT 10H.
        POP     CX
        INC     CURSOR_Y                ;Keep going on thie line.
        LOOP    WIPE                    ;Loop over all 25 linee.
        MOV     CURSOR_X,6              ;Set up for prompt.
        MOV     CURSOR_Y,24
        CALL    SET_CURSOR              ;Put the generel prompt on.
        MOV     AH,9
        MOV     DX,OFFSET PROMPT
        INT     21H
        MOV     CURSOR_X,0              ;Reeet to beginning of the ecreen.
        MOV     CURSOR_Y,0
        CALL    SET_CURSOR
        MOV     DI,TEST_PATH_END
        CMP     NOFILE_FLAG,1           ;If no filename given, ekip firet search
        JE      TSLASH
        CMP     BYTE PTR [DI-1],'\'     ;Nee a filename given?
        JE      NOFILE
        CMP     D1_FLAG,1               ;Are we doing DISPLAY or DSPLAY2?
        JE      PUTA                    ;In DISPLAY, filename all set.
        CMP     FILENAME,0              ;Did FILENAME find filee firet time?
        JE      PUTA
        MOV     CX,10
        MOV     SI,OFFSET FILENAME      ;Use FILENAME insteed of WILDCARDS.
        MOV     DI,SOURCE_PATH_END
REP     MOVSB
PUTA:   MOV     AH,4EH                  ;Search for matchee to filename.
        MOV     DX,SOURCE               ;QQQ
        INT     21H                     ;Wee a filename given?
        JNC     MATCH1                  ;Yee, no need for wildcards.
NOFILE: MOV     FILENAME,0              ;No given filename worked in DISPLAY.
TSLASH: CMP     TEST_PATH_END,0         ;Any pathname cheractere typed?
        JNE     SLASH                   ;Yee, check '\'
        MOV     SOURCE_PATH_END,SOURCE  ;No, use SOURCE to load wildcards et.
        MOV     DI,SOURCE_PATE_END      ;Set up widcards -- *.* -- et end of
        JMP     PUTW                    ; SOURCE.
SLASH:  MOV     DI,TEST_PATH_END
        MOV     SOURCE_PATH_END,DI
        CMP     BYTE PTR [DI-1],'\'     ;If there ie no '\',
        JE      PUTW                    ; put one in.
        MOV     BYTE PTR [DI],'\'
        INC     DI
        INC     SOURCE_PATH_END         ;INC DI end Path_End by adding '\'.
PUTW:   MOV     CX,4
        MOV     SI,OFFSET WILDCARDS
REP     MOVSB                           ;Move *.* into place.
SRC:    MOV     AH,4EH                  ;Hearch for matchee to wildcerd
        MOV     DX,SOURCE
        INT     21H                     ;Look for match.
        JC      ENDER                   ;If error, leave.
MATCH1: MOV     DX,0
        MOV     AH,2
        INT     10H
        CALL    PRINT                   ;Print oot filename with PRINT.
        MOV     CX,128                  ;128 filee max.
```

*(Figure 1 continues)*


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## ■ PROGRAMMING/UTILITIES

```
LOOPER: MOV     AH,4FH                  ;Search for next match, if there is one.
        INT     21H
        JC      ENDER                   ;If none, leave.
        MOV     DISP_FLAG,0FFH          ;This is a DISPLAY, do not check for
        CALL    INC_CURSDR              ; empty screen ahead of highlight.
        MOV     DISP_FLAG,0             ;Use DISP_FLAG as signal to INC_CURSOR.
        CALL    PRINT
        MOV     DX,DFFSET SOURCE        ;Get ready for search.
        LOOP    LOOPER
ENDER:  MOV     CURSDR_X,0              ;Set cursor to top of screen when done.
        MOV     CURSDR_Y,0
        CALL    SET_CURSOR
        RET
DISPLAY ENDP

INC_CURSDR      PROC    NEAR            ;This moves the highlight to the next
        PUSH    CX                      ;filename on the screen.
        MOV     DL,CURSDR_X             ;Where are we now?
        MOV     DH,CURSOR_Y
        MOV     TEMPX,DL                ;Store in temporary locations.
        MOV     TEMPY,DH
        ADD     DL,13                   ;See if we can move to the right.
        CMP     DL,75                   ;Past edge of screen?
        JL      PIN                     ;No, go ahead.
        MOV     DL,0                    ;Yes, wrap around.
        INC     DH
PIN:    MOV     CURSOR_X,DL             ;Store new positions.
        MOV     CURSDR_Y,DH
        MOV     DX,0                    ;Return OR signal.
        CALL    SET_CURSOR              ;And set new cursor.
        CMP     DISP_FLAG,0             ;Is this a DISPLAY?
        JNS     SET                     ;Yes, don't check if we are pointing to
        MOV     SI,SOURCE_PATH_END      ; a filename.
        CALL    GET_FILE_NAME           ;Are we pointing to a filename?
        CMP     BYTE PTR DS:[SI],' '
        JA      SET                     ;Yes.
        SUB     CURSDR_X,13             ;No, move back one position.
        CMP     CURSDR_X,0
        JG      LEAV                    ;And exit.
        MOV     DL,TEMPX
        MOV     CURSOR_X,DL             ;Restore temporary (original) positions.
        MOV     DH,TEMPY
        MOV     CURSDR_Y,DH
LEAV:   CALL    SET_CURSDR              ;CURSOR_X and CURSDR_Y all set, now
        MOV     DX,0FFH                 ; actually do set cursor.
SET:    POP     CX
        RET                             ;And Return.
INC_CURSOR      ENDP
                                        ;This sets cursor location on screen.
SET_CURSDR      PROC    NEAR
        PUSH    AX                      ;Save AX.
        MOV     DL,CURSDR_X             ;Get position cursor should be at.
        MOV     DH,CURSOR_Y
        MOV     AH,2
        INT     10H                     ;Use Service 2, INT 10H, and move it
        POP     AX                      ; there.
        RET                             ;And return.
SET_CURSDR      ENDP

PRINT   PROC    NEAR                    ;This prints out filenames.
        PUSH    CX
        MOV     DX,80H+30               ;Point to name.
        MOV     BX,DX
        MOV     CX,13
LOOPA:  CMP     BYTE PTR [BX],0         ;Is it a 0?
        JE      FOUND                   ;Yes, end of filename found.
        INC     BX
        LOOP    LOOPA
FOUND:  MOV     BYTE PTR DS:[BX+1],'$'  ;Put '$' in place.
        MOV     AH,9                    ;Use String Print.
        INT     21H
        POP     CX
        RET                             ;Return.
PRINT   ENDP
DATA:                                   ;Will store 62K of data for copies
CODE_SEG        ENDS                    ; after this point.
        END     START
```

*(Figure 1 ends)*

■ Bytes 26–27 hold the number that represents the file's *starting cluster*. Files on a disk are stored in *clusters* of sectors, and these clusters are the pieces that the file allocation table keeps track of. How many sectors there are in a cluster varies with disk size (typically, one cluster contains two 512-byte sectors), and for each cluster on the disk there is an entry in the file allocation table. To read a file, then, a pro-


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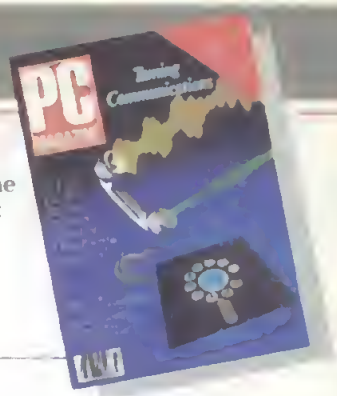


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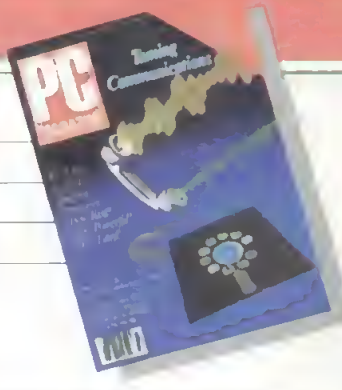


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```
100 REM -- BASIC PROGRAM TO CREATE DIREX.COM
110 OPEN "DIREX.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  249
150    LINESUM = 0
160    FOR J = 1 TO 8
170       READ BYTE
180       CHECKSUM = CHECKSUM + BYTE
190       LINESUM = LINESUM + BYTE
200       IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ LINECHECK
240    IF LINECHECK <> LINESUM THEN PRINT "Error in Line";200 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 197803 THEN PRINT "Succeeeful Completion!" : END
280 PRINT "COM file is not valid!" : END
290 DATA    233,    37,     1,    80,    81,    68,   101,   100,   677
300 DATA    101,   116,   101,    32,    80,    61,    80,   114,   685
310 DATA    111,   116,   101,    99,   110,    32,    85,    61,   721
320 DATA     85,   110,   112,   114,   111,   116,   101,    99,   848
330 DATA    116,    32,    87,    61,    67,   111,   112,   121,   887
340 DATA     32,    68,    83,   112,    97,    99,   101,    62,   646
350 DATA     61,    77,    97,   114,   107,    32,    78,    81,   627
360 DATA     78,   101,   119,    32,    68,   105,   114,    32,   649
370 DATA     81,    61,    81,   117,   105,   116,    36,    80,   677
380 DATA     97,   116,   104,   110,    97,   109,   101,    32,   786
390 DATA    116,   111,    32,    99,   111,   112,   121,    32,   734
400 DATA    109,    97,   114,   107,   101,   100,    32,   102,   782
410 DATA    105,   100,   101,   115,    32,   116,   111,    58,   746
420 DATA     32,    36,    78,   101,   119,    32,    80,    97,   575
430 DATA    116,   104,   110,    97,   109,   101,    58,    32,   727
440 DATA     36,    42,    32,    32,    32,    32,    32,    32,   270
450 DATA     32,    32,    84,    85,    82,    71,    69,    84,   519
460 DATA     32,    68,    73,    83,    75,    32,    78,    85,   510
470 DATA     76,    76,    33,    32,    32,    32,    32,    32,   345
480 DATA     32,    32,    32,    32,    32,    42,    36,    80,   308
490 DATA    101,   100,   101,   116,   101,    32,    77,    97,   733
500 DATA    114,   107,   101,   100,    32,    78,   105,   100,   737
510 DATA    101,   115,    32,    40,    89,    47,    78,    41,   543
520 DATA     63,    32,    36,     0,     0,     0,     0,     0,   131
530 DATA      0,     0,     0,     0,   176,     0,   219,     0,   395
540 DATA      0,     0,     0,     0,     0,     0,     0,     7,     7
550 DATA     42,    46,    42,     0,     0,     0,     0,     0,   130
560 DATA      0,     0,     0,     0,     0,     0,     0,     0,     0
570 DATA      0,     0,    67,   111,   112,   121,   114,   105,   630
580 DATA    103,   104,   116,    32,    49,    57,    56,    54,   571
590 DATA     32,    98,   105,   102,   102,    45,    68,    97,   641
600 DATA    110,   105,   115,    32,    80,   117,    98,   100,   773
610 DATA    105,   115,   104,   105,   110,   103,    32,    67,   741
620 DATA    111,    46,    26,    80,   114,   111,   103,   114,   785
630 DATA     97,   109,   109,   101,   100,    32,    98,   121,   767
640 DATA     32,    83,   116,   101,   110,   101,   110,    32,   693
650 DATA     72,   111,   100,   122,   110,   101,   114,    26,   764
660 DATA    232,   186,     4,   139,    54,   196,     1,   232,  1024
670 DATA     36,     4,   198,     8,   207,     1,   112,   232,   798
680 DATA     71,     4,   100,     8,   205,    22,    80,    32,   574
690 DATA    117,    43,   100,     8,   107,     8,     8,   120,   603
700 DATA      6,   212,     1,    12,   232,    74,     8,   205,   748
710 DATA     16,    80,   255,   110,     5,   170,   255,   235,  1118
720 DATA      3,   144,   176,     8,   100,    10,   105,     1,   699
730 DATA      8,   205,    10,   120,    40,   212,     1,    12,   820
740 DATA    232,    46,     6,   235,   205,   120,   252,    77,  1101
750 DATA    117,    21,   198,     6,   207,     1,     7,   232,   789
760 DATA      7,     4,   232,   100,     5,   198,     6,   207,   845
770 DATA      1,   112,   232,   252,     3,   235,   179,   120,  1142
780 DATA    252,    75,   117,    50,   130,    22,   212,     1,   875
790 DATA    130,    54,   213,     1,   198,     6,   207,     1,   810
800 DATA      7,   232,   229,     3,   120,   234,    13,   115,   901
810 DATA     15,   170,    65,   120,   238,     1,   115,     8,   740
820 DATA    130,    22,   212,     1,   130,    54,   213,     1,   779
830 DATA    136,    22,   212,     1,   130,    54,   213,     1,   775
840 DATA    232,   222,     5,   198,     6,   207,     1,   112,   983
850 DATA    232,   198,     3,   233,   110,   255,   120,   252,  1409
860 DATA     72,   117,    46,   130,    22,   212,     1,   130,   746
870 DATA     54,   213,     1,   198,     8,   207,     1,     7,   807
880 DATA    232,   166,     3,   120,   238,     1,   115,     3,   886
890 DATA    120,   198,     1,   136,    22,   212,     1,   136,   834
900 DATA     54,   213,     1,   232,   171,     5,   198,     8,   880
910 DATA    207,     1,   112,   232,   139,     3,   233,    85,   992
920 DATA    255,   120,   252,    80,   117,    45,   198,     6,  1081
930 DATA    207,     1,     7,   232,   123,     3,   254,     8,   833
940 DATA    213,     1,   232,   140,     5,   139,    54,   196,   980
950 DATA      1,   232,    66,     3,   120,    60,    32,   119,   841
960 DATA      7,   254,    14,   213,     1,   232,   121,     5,   847
970 DATA    198,     6,   207,     1,   112,   232,    89,     3,   848
```

*(continues)*

**Figure 2:** *The BASIC program for creating DIREX.COM.*

## DOWNLOADING DIREX

The programs that appear in our Programming/Utilities column (as well as other programs we publish) can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. Making copies for others (including placement on other electronic bulletin boards), with or without charge, is a direct violation of the Ziff-Davis copyright.

The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1,200 (or 300) bps, 8 data bits, 1 stop bit, no parity. PC-IRS files with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission.

DIREX.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create DIREX.COM when run once in BASIC. DIREX.ASM, also listgram gets the first cluster number from the file's directory entry and reads in that cluster's data. To read the next part of the file in, the program needs to know where on the disk it is stored—that is, what the next cluster of data is.

The file's next cluster number is found from the file allocation table. The program checks the FAT entry for the cluster it just read in. Recorded there is the number of the cluster on the disk for the next part of the file. After reading in that next cluster, the program checks that cluster's entry in the file allocation table and finds the next cluster after that to read. This way, the program can chain from cluster to cluster on the disk. You might have assumed that a file is stored on the disk in pieces right next to each other, but that rarely happens. When it is storing a file, DOS takes the

*("Downloading DIREX" continued)*

ed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft) and to enter the following commands:

```
MASM DIREX;
LINK DIREX;
EXE2BIN DIREX DIREX.COM
```

## DIREX AT A GLANCE

Syntax:

`DIREX [d:] [filespec]`

Operation: DIREX is used to copy, delete, protect, or unprotect selected files in a directory. On entry, DIREX presents a screen that lists up to 120 filenames, which may be restricted by extension and/or DOS wildcards (? and *). Within the display, files are marked (or unmarked) by moving the reverse video cursor to them with the cursor keys and then pressing the spacebar. Hitting C (copy), D (delete), P (protect by making read-only) and U (unprotect) initiates action on the marked files. N (new directory) can be used within DIREX to change directories, and Q clears the screen and returns you to the DOS command level.

next available cluster, and since files get deleted and rewritten, a cluster can get written all over the disk.

■ Bytes 28–31, the final bytes of the directory entry, hold the file's size in bytes.

And that's all there is to DOS's directory structure. If you're intrepid, you can read in the directory from a disk directly with DEBUG and take a look. There are easier ways of managing your directory, though. For instance, there's DIREX.

*Steven Holzner, a contributing editor of* PC Magazine, *is doing graduate work at Cornell University's Laboratory of Nuclear Studies.*

```
800 DATA    233,    15,   255,    68,    98,   124,     2,    44,   823
900 DATA     32,    60,    81,   117,    55,   105,    25,     8,   555
1000 DATA   108,     6,   212,     1,     8,   190,     6,   213,   834
1010 DATA     1,     8,   232,    84,     5,    81,   232,    80,   715
1020 DATA     5,   105,    80,     8,   180,     9,   107,     7,   653
1030 DATA     8,   176,     8,   205,    16,    80,   254,     6,   746
1040 DATA   213,     1,   226,   233,   198,     6,   212,     1,  1098
1050 DATA     8,   198,     6,   213,     1,     8,   232,    48,   698
1060 DATA     5,   233,   165,     2,    60,    60,   116,     3,   652
1070 DATA   233,   133,     8,   198,     6,   207,     1,     7,   785
1080 DATA   232,     6,     3,   198,     6,   212,     1,     8,   658
1090 DATA   108,     6,   213,     1,    24,   232,    17,     5,   606
1100 DATA   100,     9,   105,    80,     8,   176,    32,   107,   849
1110 DATA     7,     8,   205,    16,   198,     6,   212,     1,   645
1120 DATA     8,   198,     6,   213,     1,    24,   232,   208,   922
1130 DATA     4,   100,     9,   106,   159,     1,   205,    33,   777
1140 DATA   100,     1,   205,    33,    60,    90,   124,     2,   695
1150 DATA    44,    32,    60,    89,   116,    14,   232,   123,   718
1160 DATA     3,   198,     6,   207,     1,   112,   232,   192,   951
1170 DATA     2,   233,   110,   254,   100,     6,   212,     1,  1024
1180 DATA     8,   198,     6,   213,     1,     8,   232,   200,   858
1190 DATA     4,   232,    63,     2,   106,   176,     8,   100,   843
1200 DATA    65,   205,    33,   232,    89,     4,   129,   250,  1007
1210 DATA   255,     8,   116,     6,   129,   249,   255,     8,  1018
1220 DATA   117,   231,   232,    71,     3,   190,     6,   207,  1065
1230 DATA     1,   112,   232,   140,     2,   233,    66,   254,  1048
1240 DATA    60,    80,   117,    65,   198,     6,   207,     1,   734
1250 DATA     7,   232,   125,     2,   198,     6,   212,     1,   703
1260 DATA     8,   100,     6,   213,     1,     8,   232,   136,   706
1270 DATA     4,   232,   255,     1,   106,   176,     8,   100,  1034
1280 DATA    67,   176,     1,   105,     1,     8,   205,    33,   668
1290 DATA   232,    20,     4,   129,   250,   255,     8,   116,  1006
1300 DATA     6,   129,   240,   255,     8,   117,   226,   232,  1214
1310 DATA     2,     3,   190,     6,   207,     1,   112,   232,   761
1320 DATA    71,     2,   233,   253,   253,    60,    85,   117,  1076
1330 DATA    65,   198,     6,   207,     1,     7,   232,    56,   772
1340 DATA     2,   198,     6,   212,     1,     8,   100,     6,   623
1350 DATA   213,     1,     8,   232,    67,     4,   232,   186,   935
1360 DATA     1,   106,   176,     8,   100,    67,   176,     1,   707
1370 DATA   105,     8,     8,   205,    33,   232,   207,     3,   865
1380 DATA   120,   250,   255,     8,   116,     6,   120,   240,  1134
1390 DATA   255,     8,   117,   226,   232,   100,     2,   100,  1210
1400 DATA     6,   207,     1,   112,   232,     2,     2,   233,   795
1410 DATA   104,   253,    60,    67,   116,     3,   233,    60,   976
1420 DATA     1,   100,     6,   190,     1,     8,   100,     6,   608
1430 DATA   207,     1,     7,   232,   235,     1,   190,     6,   887
1440 DATA   212,     1,     8,   198,     6,   213,     1,    24,   655
1450 DATA   232,   246,     3,   100,     8,   105,    80,     8,   935
1460 DATA   176,    32,   187,     7,     8,   205,    16,   198,   821
1470 DATA     6,   212,     1,     8,   198,     6,   213,     1,   637
1480 DATA    24,   232,   221,     3,   100,     8,   106,    71,   926
1490 DATA     1,   205,    33,   100,    10,   107,   214,     8,   838
1500 DATA   106,   214,     8,   198,     7,    32,   205,    33,   875
1510 DATA   190,   216,     8,   128,    68,    13,   116,     3,   726
1520 DATA    70,   235,   240,   120,   124,   255,    92,   116,  1268
1530 DATA     4,   100,     4,    92,    70,   137,    54,   190,   757
1540 DATA     1,   100,     6,   207,     1,     7,   232,   144,   796
1550 DATA     1,   100,     6,   212,     1,     8,   190,     6,   622
1560 DATA   213,     1,     8,   232,   155,     3,   100,     6,   800
1570 DATA   107,     1,     1,   232,    13,     1,   190,     6,   630
1580 DATA   107,     1,     8,   120,   249,   255,     8,   117,   930
1590 DATA     3,   233,   163,     8,   106,   176,     8,   104,   945
1600 DATA     8,    61,   205,    33,   114,   100,   163,   192,   876
1610 DATA     1,   106,   216,     8,   100,    60,   105,     8,   820
1620 DATA     8,   205,    33,   114,    93,   163,   194,     1,   803
1630 DATA   106,   195,     8,   105,     8,   248,   100,    63,  1065
1640 DATA   139,    30,   192,     1,   205,    33,   163,   202,   965
1650 DATA     1,   130,   200,   137,    14,   204,     1,   100,   876
1660 DATA    64,   139,   -30,   194,     1,   106,   195,     8,   817
1670 DATA   205,    33,    59,     6,   204,     1,   117,    11,   636
1680 DATA   129,    62,   202,     1,     8,   240,   116,   200,   966
1690 DATA   235,    40,   144,   198,     6,   212,     1,     8,   836
1700 DATA   100,     6,   213,     1,    24,   232,    41,     3,   718
1710 DATA   141,    22,   121,     1,   100,     9,   205,    33,   712
1720 DATA   190,     6,   190,     1,     1,   198,     6,   212,   812
1730 DATA     1,     8,   198,     6,   213,     1,     8,   232,   651
1740 DATA    15,     3,   100,    62,   139,    30,   192,     1,   622
1750 DATA   205,    33,   100,    62,   139,    30,   104,     1,   844
1760 DATA   205,    33,   120,    62,   100,     1,     1,   117,   737
1770 DATA    10,   106,   216,     8,   100,    65,   205,    33,   805
1780 DATA   233,   135,   252,   232,   137,     2,   129,   250,  1370
1790 DATA   255,     8,   116,     3,   233,    71,   255,   232,  1165
1800 DATA   122,     1,   198,     6,   207,     1,   112,   232,   879
1810 DATA   101,     8,   233,   117,   252,    60,    70,   116,  1047
1820 DATA     3,   233,   110,   252,   198,     6,   207,     1,  1010
1830 DATA     7,   232,   173,     8,   198,     6,   212,     1,   829
1840 DATA     8,   198,     6,   213,     1,    24,   232,   104,   858
1850 DATA     2,   100,     8,   105,    80,     8,   176,    32,   664
1860 DATA   107,     7,     8,   205,    16,   198,     6,   212,   831
1870 DATA     1,     8,   198,     6,   213,     1,    24,   232,   675
```

*(Figure 2 continues)*

```
1880 DATA 159,   2, 180,   9, 180, 180,   1, 205, 848
1890 DATA  33, 180,  10, 187, 128,   0, 180, 128, 852
1900 DATA   8, 190,   7,  32, 205,  33, 233,  23, 731
1910 DATA 252, 205,  32, 180,   8, 128,   6, 212, 1023
1920 DATA   1,  12, 232, 124,   2, 187,   0,   0, 558
1930 DATA 205,  16, 128,  46, 212,   1,  12, 232, 852
1940 DATA 111,   2,  80, 255, 116,  15, 232,   6, 797
1950 DATA   2, 129, 250, 255,   0, 117, 220, 105, 1158
1960 DATA 255,   0, 235,  25, 144, 105,   0,   0, 844
1970 DATA 139,  54, 190,   1, 232,  15,   8, 128, 765
1980 DATA  62, 187,   1,   1, 117,   7, 139,  54, 568
1990 DATA 190,   1, 232,   1,   0, 195,  81,  80, 794
2000 DATA 255,  54, 212,   1, 188,   8, 187,   8, 897
2010 DATA   0, 185,  12,   0, 180,   8, 205,  16, 686
2020 DATA 254,   0, 212,   1, 232,  42,   2, 130, 885
2030 DATA   4,  78, 226, 248, 190,   4,   8, 143, 885
2040 DATA   6, 212,   1,  94, 232,  20,   2,  89, 862
2050 DATA 195,  81, 255,  54, 212,   1, 185,  12, 995
2060 DATA   0, 128,  62, 207,   1,   7, 117,  27, 549
2070 DATA 180,   8, 128,   6, 212,   1,  12, 232, 779
2080 DATA 255,   1, 187,   0,   8, 205,  16, 128, 792
2090 DATA  46, 212,   1,  12, 232, 242,   1,  60, 806
2100 DATA 255, 110,  29, 187,   8,   8, 180,   0, 775
2110 DATA 205,  16,  81, 185,   1,   0, 136,  30, 656
2120 DATA 207,   1, 180,   9, 205,  16,  89, 254, 961
2130 DATA   6, 212,   1, 232, 211,   1, 226, 227, 1116
2140 DATA 143,   6, 212,   1, 232, 202,   1,  89, 880
2150 DATA 195, 191, 176,   8, 190,   6, 180,   1, 955
2160 DATA   1, 190, 130,   0, 199,   6, 190,   1, 723
2170 DATA 176,   0, 187, 128,   0, 128,  63,   0, 682
2180 DATA 116,  74, 128,  60,  13, 116,  54, 164, 725
2190 DATA 120, 124, 255,  92, 110,   6, 120, 124, 973
2200 DATA 255,  50, 117, 238, 137,  62, 190,   1, 1864
2210 DATA  86,  87, 141,  62, 216,   1, 185,  10, 788
2220 DATA   0, 176,   0, 243, 170, 141,  82, 210, 1000
2230 DATA   1, 185,   9,   0, 128,  60,  13, 117, 513
2240 DATA   5, 190,   5,   0, 235,   3, 104, 220, 830
2250 DATA 243,  95,  94, 235, 197, 190,   5,   0, 1067
2260 DATA 137,  62, 200,   1, 190,   6, 191,   1, 790
2270 DATA   0, 235,  10, 144, 190,   6, 180,   1, 798
2280 DATA   0, 128,  62, 210,   1,   0, 117,   5, 529
2290 DATA 190,   0, 191,   1,   1, 185,  25,   0, 607
2300 DATA 190,   6, 212,   1,   0, 190,   0, 213, 834
2310 DATA   1,   0, 232,  60,   1,  81, 232,  84, 679
2320 DATA   1, 185,  80,   0, 180,   9, 187,   7, 649
2330 DATA   0, 170,   0, 205,  16,  89, 254,   6, 746
2340 DATA 213,   1, 226, 233, 190,   6, 212,   1, 1090
2350 DATA   0, 190,   6, 213,   1,  24, 232,  32, 712
2360 DATA   1, 180,   9, 186,   3,   1, 205,  33, 810
2370 DATA 190,   6, 212,   1,   0, 190,   6, 213, 834
2380 DATA   1,   0, 232,  12,   1, 139,  82, 200, 847
2390 DATA   1, 120,  62, 191,   1,   1, 116,  46, 546
2400 DATA 120, 125, 255,  92, 110,  35, 120,  62, 941
2410 DATA 180,   1,   1, 116,  19, 128,  62, 216, 731
2420 DATA   1,   0, 110,  12, 185,  10,   0, 190, 514
2430 DATA 210,   1, 139,  62, 196,   1, 243, 104, 1022
2440 DATA 180,  70, 180, 176,   0, 205,  33, 115, 973
2450 DATA  64, 190,   0, 210,   1,   0, 131,  62, 670
2460 DATA 200,   1,   0, 117,  13, 199,   0, 190, 732
2470 DATA   1, 176,   0, 139,  82, 190,   1, 235, 810
2480 DATA  23, 144, 139,  62, 200,   1, 137,  62, 780
2490 DATA 196,   1, 120, 125, 255,  92, 116,   0, 921
2500 DATA 190,   5,  92,  71, 255,   0, 190,   1, 824
2510 DATA 185,   4,   0, 190, 200,   1, 243, 164, 995
2520 DATA 180,  70, 186, 176,   0, 205,  33, 114, 972
2530 DATA  40, 186,   0,   0, 180,   2, 205,  16, 629
2540 DATA 232, 157,   0, 185, 120,   0, 180,  79, 953
2550 DATA 205,  33, 114,  21, 190,   0, 189,   1, 787
2560 DATA 255, 232,  27,   0, 190,   6, 189,   1, 900
2570 DATA   0, 232, 132,   0, 186, 170,   0, 220, 952
2580 DATA 229, 190,   0, 212,   1,   0, 190,   0, 850
2590 DATA 213,   1,   0, 232,  99,   0, 195,  81, 821
2600 DATA 130,  22, 212,   1, 130,  54, 213,   1, 779
2610 DATA 136,  22, 214,   1, 136,  54, 215,   1, 779
2620 DATA 120, 194,  13, 120, 250,  75, 124,   4, 916
2630 DATA 170,   0, 254, 190, 136,  22, 212,   1, 1001
2640 DATA 136,  54, 213,   1, 186,   0,   0, 232, 822
2650 DATA  55,   0, 120,  82, 189,   1,   0, 117, 552
2660 DATA  40, 139,  54, 190,   1, 232, 230, 253, 1151
2670 DATA 120,  60,  32, 119,  34, 120,  40, 212, 759
2680 DATA   1,  13, 120,  62, 212,   1,   0, 127, 544
2690 DATA  16, 130,  22, 214,   1, 130,  22, 212, 781
2700 DATA   1, 130,  54, 215,   1, 136,  54, 213, 812
2710 DATA   1, 232,   5,   0, 186, 255,   0,  89, 768
2720 DATA 195,  80, 130,  22, 212,   1, 130,  54, 840
2730 DATA 213,   1, 180,   2, 205,  16,  80, 195, 980
2740 DATA  81, 186, 150,   0, 139, 210, 185,  13, 980
2750 DATA   0, 120,  63,   0, 116,   3,  67, 220, 603
2760 DATA 240, 190,  71,   1,  30, 180,   9, 205, 948
2770 DATA  33,  89, 195,   0,   0,   0,   0,   0, 317
```

*(Figure 2 ends)*


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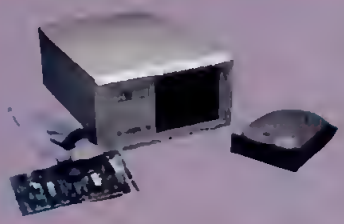

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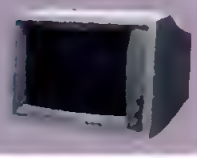

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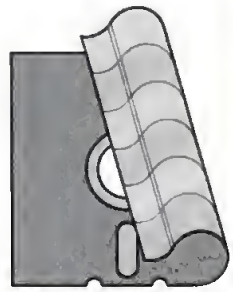
# SPREADSHEET CLINIC



*Adding a notepad keyed to individual cells, figuring values for paid-in-advance annuities, sprucing up spreadsheet borders, and using 1-2-3 for BASIC data entry.*

## CELL-REFERENCE NOTEPAD

It's often helpful to keep notes about the contents of certain cells when you're working with large spreadsheets. While there are several add-on programs designed to do this, they are more complicated than necessary, so I wrote my own for *1-2-3*, Release 2.0.

The two macros in Figure 1 can be used to look up entries in the notepad and to add notes about individual cells. When you hit Alt-Q from anywhere in the spreadsheet, the screen will split horizontally, revealing the notepad, and you'll be prompted to enter the address of the cell you need information about. The screen will always split so that cell the cursor was initially on remains visible in the upper window.

Figure 2 shows a sample notepad. You enter the address of the cell you want information about in cell N4. If there is a note attached to that cell, the cursor will move to it. After reading the note, just hit Enter again. The screen and the cursor will be restored to the point just before you began the query. If you have made no note referring to that cell you'll see a message to that effect, you'll hear a beep, and 2 seconds later the screen will return to its original state.

If you want to write a note about a cell, hit Alt-N. The screen will again split and the cursor will move to a fresh line at the bottom of the notepad. Enter the address of the cell and enter the note message. The screen will then return to its original state.

Some pointers on implementation: The notepad itself is a database and uses /Data Query Find. You must execute that operation first so that the macro will work when you simply use {query}. In the example in Figure 2, the input range begins in N6 and extends to column O and down as many rows as necessary. The criterion range is N3. .N5. This contains the heading of the database, the address you enter as the search criterion, and 999,999, which is used as a second search criterion.

In the example in Figure 2, the cell address that becomes the first search criterion is A18. As you can see from the notepad, there is no note attached to cell A18, so the {query} operation won't find one. It *will* find 999,999, however, because every cell in column N from row 12 on down contains that number. There is no display, because the contents are hidden with /Range Format Hidden. As you add notes, their addresses will overwrite the 999,999s. Unlike the 999,999s, the addresses become visible because of the format reset sequence in line 7 of macro \N, which "unhides" the contents. If you want, you can hide cells N3 and N5, should you find their contents distracting.

When the {query} operation finds a 999,999 instead of a cell address, the @cellpointer ("contents") test that takes place in line 8 of the \Q macro makes macro execution branch to NO. This is the part of the macro that displays the "error" message and returns you to the pre–query screen. If macro execution does not branch

```
\Q   {PANELOFF}{WINDOWSOFF}
     {DOWN 6}{UP 5}
     /WWH/WWU{WINDOW}
     {GOTO}HEADING~{DOWN}/WTH{GOTO}ENTER~
     {WINDOWSON}{PANELON}{?}~
     {WINDOWSOFF}{PANELOFF}
     {QUERY}{QUERY}
     {IF @CELLPOINTER("CONTENTS")=999999}{BRANCH NO}
     {RIGHT}{WINDOWSON}{PANELON}{?}
     {WINDOWSOFF}{PANELOFF}
     /WTC/WWC{QUIT}
NO   {RIGHT}{WINDOWSON} NO NOTE AVAILABLE FOR THIS CELL~
     ~{BEEP}{WAIT @NOW+@TIME(0,0,02)}{WINDOWSOFF}
     /RE~/WTC/WWC


\N   {PANELOFF}{WINDOWSOFF}
     {DOWN 6}{UP 5}
     /WWH/WWU{WINDOW}
     {GOTO}HEADING~{DOWN}/WTH
     {GOTO}FIRST~{END}{DOWN}{DOWN}{LEFT}
     {WINDOWSON}{PANELON}{?}~
     /RFR~{RIGHT}{?}~
     {WINDOWSOFF}{PANELOFF}
     /WWC
```

**Figure 1:** *Macro \Q queries the notepad for information, and macro \N creates new notes to attach to other cells.*

## ■ SPREADSHEET CLINIC

```
      M       N                          O
-------------------------------------------------------------------------
 3  HEADING ADDRESS                    N O T E  -  P A D
 4  ENTER   A18       <--- ENTER HERE CELL ADDRESS OF ITEM BEING QUERIED
 5          999,999
 6          ADDRESS
 7          F3       Turn off window and panel.
 8          F7       Set cursor so queried cell stays visible.
 9          H1       Set windows, unsynchronize them, switch windows.
10          H2       Set titles, prepare for address entry.
11          H3       Window/panel on, pause.
12
13
14
```

**Figure 2:** *A sample notepad for identifying cell contents.*

to NO, the note is displayed for you to read and the macro pauses. After you hit Enter, the pre–query screen reappears.

In Figure 2, all cells must have the range names displayed in the left-hand column. Furthermore, in addition to the data ranges, there are three named ranges. Cells N3 and N4 are HEADING and ENTER, respectively.

Though it is not indicated in the figure, do not fail to give cell 07 the name FIRST. It is used when macro \ N adds new notes. As you can see, there is a lot of windowsoff/windowson and paneloff/panelon. This is strictly cosmetic and keeps the screen from flashing.

Sami Barrage
Jeddah, Saudi Arabia

*It may take a little time to implement this pair of sophisticated macros, but it's worth it. You can keep the money you might have spent on one of those commercial note programs.*

### MORE ON FUTURE VALUE

A recent submission in Spreadsheet Clinic (Volume 5 Number 20) from Ron Pokornowski showed how to calculate simple present value and future value in *1-2-3*. I would add a note of caution about using the @ FV function itself, which calculates the future value of an annuity.

The function calculates the value of an annuity paid in arrears, that is to say, at the end of the period. Thus, using the example shown in Figure 3, if you make IRA payments for 3 years at the end of each year and the interest rate on the IRA is 10 percent, you will have $6,620 at the end of the 3 years. However, if you make your IRA contribution at the beginning of each year, you can't use the *1-2-3* @ FV function as is. You must add to it, as shown in the second formula in Figure 3, to get the right answer. The difference is considerable.

Stan Trost
Walnut Creek, California

*Lotus's manual for Release 1A doesn't explain the difference between the two kinds of annuity. It says nothing about when during the period the payment is made. Mr. Trost is correct, however, that the formula works for payments in arrears, not in advance. The manual for Release 2.0 is more thorough. It explains the difference and suggests the following modification of the @ FV function for an annuity paid in advance:*

```
PAYMENT        2000
RATE             10%
YEARS             3

@fv(PAYMENT,RATE,YEARS)
  = $6620

@fv(PAYMENT,RATE,YEARS+1)-PAYMENT
  = $7282
```

**Figure 3:** *Two future-value calculations: the first based on payments made in arrears; the second, in advance.*

```
@fv(PAYMENT,RATE,YEARS)*(1+RATE)
```

*This will work exactly like Mr. Trost's fix. The Release 2.0 manual also describes a similar solution for finding the present value of an annuity in advance.*

### BASIC EDITING WITH A SPREADSHEET

*PC Magazine* often publishes listings of very handy assembly language utility programs. If you don't have a Macro Assembler or a modem, however, or if you get a busy signal every time you dial the PC Magazine Interactive Reader Service, you're stuck with generating the .COM program by writing a BASIC program.

Just about any editor is better than the BASIC editor, but a spreadsheet may be the very best way to enter all those data statements. I use *1-2-3*, but any spreadsheet that can print a worksheet to disk as an ASCII file should work fine.

To start with, use the /Data Fill command, with a step value of 10, to write the line numbers. For the commas, set the width of a column to one and copy a comma down as far as necessary. Then copy the column of commas to wherever you need one.

Next, use that classic data entry macro:

```
\D  {?} {down}/xg\D~
```

This lets you turn on NumLock and use the number pad to enter data down an entire column. *[When you use this macro with NumLock on, the cursor will move down one row every time you hit Enter, so you lose nothing for having disabled the arrow keys. Use Ctrl-Break to end the macro.—Ed.]* When you're through, check to be sure that all the data columns are the same length. Finally, when there are a lot of repeated 0s, you can fill in many of them with the /Copy command.

Before printing to disk, set the left margin to 0 and the right margin to 132 and choose the Unformatted option to suppress headers, footers, and page breaks. After you print, rename your file from FILENAME.PRN to FILENAME.BAS, and it should be ready to run!

If you use a spreadsheet to write the BASIC program, it may be even easier than typing in the assembler code—though it's not as educational.

Jeffrey Bowen
Hendersonville, North Carolina

*I feel like I'm getting something for nothing whenever I use a spreadsheet for something other than spreadsheets.*

### ELEGANT BORDERS

The BASIC program shown in Figure 4 will create a .DIF file that contains the high-bit graphics characters supported by the IBM PC. If you use a spreadsheet that reads or translates .DIF files and can dis-

## ■ SPREADSHEET CLINIC

```
10 ' Basic Program to create BORDERS.DIF
20 OPEN "b:BORDERS.DIF" FOR OUTPUT AS #1
30 PRINT #1,"TABLE":WRITE #1,0,1:WRITE #1,""
40 PRINT #1,"VECTORS":WRITE #1,0,3:WRITE #1,""
50 PRINT #1,"TUPLES":WRITE #1,0,16:WRITE #1,""
60 PRINT #1,"DATA":WRITE #1,0,0:WRITE #1,""
70 B=176
80 A$=CHR$(B)
90 FOR I=1 TO 16
100 WRITE #1,-1,0:PRINT #1,"BOT"
110 FOR J=1 TO 3
120 WRITE #1,1,0:WRITE #1,A$
130 B=B+1
140 A$=CHR$(B)
150 NEXT J
160 NEXT I
170 WRITE #1,-1,0:PRINT #1,"EOD"
180 CLOSE:CLS
190 PRINT "BORDERS.DIF Created!":END
```

**Figure 4:** *A BASIC program to create a .DIF file containing "high-bit" border characters.*

play these characters, you can use them to spruce up an otherwise drab spreadsheet. They make very pretty boxes and borders.

Edward Jalbert
New Haven, Connecticut

*BORDERS.BAS is a short, tightly written program that performs as advertised. Many different spreadsheets should be able to process the resulting .DIF file. 1-2-3, Release 1A, certainly can, but Release 2.0 cannot. When I tried out the 2.0 translation utility on BORDERS.DIF, I got an empty worksheet as the .WK1 output. When I read the .WKS file written by the 1A translation utility into Release 2.0, I naturally got the Lotus LICS letters from foreign alphabets instead of the IBM graphics characters.*

*This is yet another incompatibility between Releases 1A and 2.0 of* 1-2-3. *Some readers have written to me of their frustration in trying to import high-bit ASCII characters into Release 2.0. I don't know of a way to do it, but if anyone does, I'd be glad to publish his solution.*

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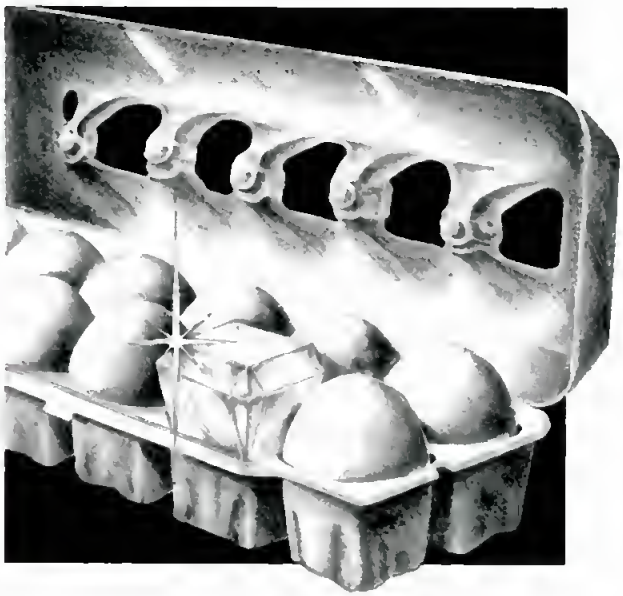

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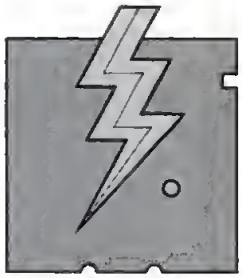
■ NEIL J. RUBENKING

# TURBO POWER USER



*Converting variables into strings, a compiler error alarm, combining Turbo with KEY-FAKE, coloring Turbo to taste, and moving files between directories.*

## USRWRITE.PAS

*Turbo Pascal procedures are declared to accept a specific set of parameters. The number and types of these parameters are fixed. Normally this is not a problem, but it can occasionally present an awkward limitation. For example, if you wanted to create your own version of the Write procedure, you would have to use several different procedures, one for each data type. Normally, you would convert all the variables involved into strings, concatenate the strings into one big string, and pass that string to your procedure. As shown in Figure 1, Glen Simpson of Dallas, Texas, has found an elegant way to bypass this awkward method, using the magic of Turbo's own Write procedure.*

*The Write procedure in Turbo is unusual in that it can accept any number or type of parameters. If the output destination is a device (e.g., CON, LST, AUX, USR), the Write code processes its multiple parameters and sends out one character at a time to an I/O driver. These I/O drivers are simple routines that accept a single character and send it to the appropriate device. The key to Mr. Simpson's procedure is that Turbo allows you to install your own I/O drivers by simply changing an internal pointer.*

*The procedure* `SaveWrite` *in Figure 1 is a user-written I/O driver. It accepts a single character, but rather than sending it to an output device, it appends it to a string. Once we assign the* `UsrOutPtr` *to the offset of this routine, all characters written to the USR device get appended to this string. If you use this procedure in your programs, just remember to initialize the string "s" before each use.*

```
PROGRAM USR_write;
VAR e : STRING[255];

  PROCEDURE SeveWrite(ch : Cher);
  BEGIN
    s := s+ch;
  END;

BEGIN
  ClrScr;
  UsrOutPtr := Ofs(SeveWrite);
  s := '';                    { initialize s        }
  Write(Usr, 'pi is ', Pi:10:6, ' and ',chr(251),2, ' ie ', Sqrt(2):1:11);
  WriteLn('The following line conteins the single string verieble "s"');
  WriteLn(e);
END.
```

**Figure 1:** *A user-defined I/O driver that allows any number of variables to be converted into a single-string variable.*

## ERROR BEEPER

*Mr. Joseph Aiello, of Kansas City, Missouri, submitted the neat little program shown in Figure 2 (along with a longer description of it that I'll summarize for you). "Change messages," as he calls it, modifies Turbo so that it beeps when it hits a compilation error. Before you run the program, however, be sure to make a copy*

```
PROGRAM ChangeMesseges;

VAR
  Messegefile : Text;
  Messagestr  : STRING[40];
  MeesegeAr   : ARRAY[1..106] OF STRING[40];
  I                 : Integer;

BEGIN
  I := 0;
  MessageAr[9] := #9 + ' ' + #7;
  Assign(Messagefile, 'TURBO.MSG');
  Reset(Messagefile);
  WHILE NOT EOF(Messegefile) DO
    BEGIN
      I := I+1;
      IF I = 9 THEN I := 10; {skip the new shorthand entry}
      ReadLn(Messegefile, Messegestr);
      IF Messegestr[1] IN ['0'..'9'] THEN Messagestr := Messagestr + #9;
      MessegeAr[I] := Messegestr;
    END;
  Rewrite(Messegefile);
  FOR I := 1 TO 106 DO WriteLn(Meesagefile, MessegeAr[I]);
  Close(Messegefile);
END.
```

**Figure 2:** *A Turbo program that modifies Turbo itself so that it will beep if it hits a compiler error.*

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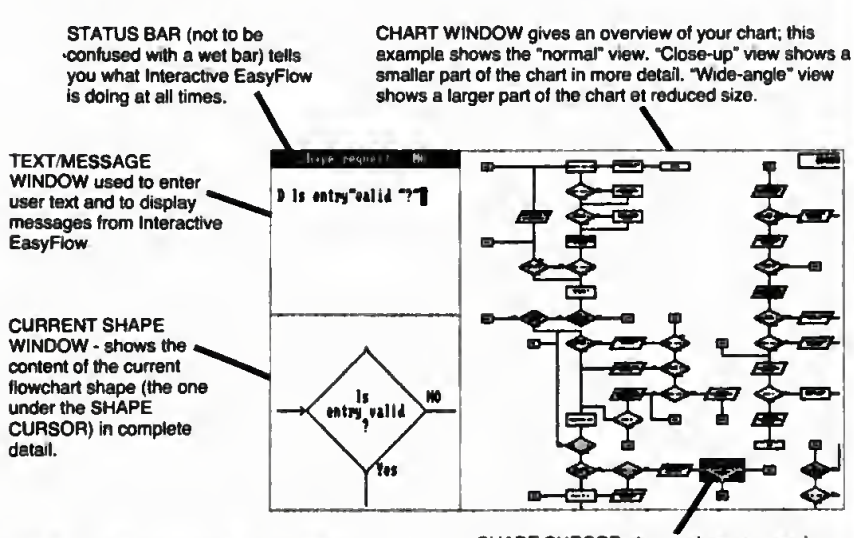


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## ■ TURBO POWER USER

*(you might call it TURBOMSG.OLD) of the TURBO.MSG file.*

*The error messages contained in TURBO.MSG use a kind of shorthand. The first 20-odd lines contain a control character (denoted, as is conventional, by a ^) and a word. The remaining lines are the actual error messages, but in these messages many words are represented by the shorthand control character. For example, error 25 is ^K^O^R^C^X, which translates as "Integer or real constant expected." The characters ^A thru ^Z are used, with some exceptions. ^M and ^J, representing the carriage return and line feed, are omitted. ^Z must be omitted, since it is the end-of-file marker. ^I, the tab character, is also left out, though it need not have been. Mr. Aiello adds a line to the "shorthand" portion of the message file that defines ^I as a space plus a "bell" character, #7. He then appends a ^I to every numbered error message. Thus, whenever an error occurs, Turbo beeps. I'm using this tip myself, starting immediately.*

### FAKING OUT TURBO

Charles Petzold's KEY-FAKE utility (Programming/Utilities, Volume 4 Number 26) provides a way to introduce keystrokes into the keyboard buffer. We had an application where we wanted to recompile a large system containing a dozen or so Turbo Pascal programs from time to time, whenever any of the commonly used include files had changed.

Unfortunately, Turbo scans the keyboard buffer while it is compiling, and whenever it sees a keystroke, it comes up with the message "Abort Compilation (Y/N)". We poked around in Turbo and came up with a patch to disable the scanning for keystrokes. The result is a version of Turbo that works with KEY-FAKE—and they make a powerful combination! The patch works with Versions 2 and 3 of Turbo, both normal and 8087.

First, at the DOS prompt, load up a copy of Turbo into DEBUG:

```
debug turbocpy.com
```

Then search for the first occurrence of "Abort"

```
-s 1ØØ ffØØ 'Abort'
xxxx:924B
```

## ■ TURBO POWER USER

The exact location may vary for different versions of Turbo. Now disassemble the preceding few bytes:

```
-u 9230
xxxx:9230 20E8          AND     AL,CH
xxxx:9232 2F            DAS
xxxx:9233 78A1          JS      91D6
xxxx:9235 0005          MOV     AL,05
xxxx:9237 E894AB        CALL    3DCE
xxxx:923A E8877B        CALL    0DA4
-------------------------------------
xxxx:923D 0AC0          DR      AL,AL
-------------------------------------
xxxx:923F 7431          JZ      9272
xxxx:9241 E83D78        CALL    0A81
xxxx:9244 2028          AND     [BX+SI],AH
xxxx:9246 282A          AND     [BP+SI],CH
xxxx:9248 2A2A          SUB     CH,[BP+SI]
xxxx:924A 204182        AND     [BX+DI+62],AL
xxxx:924D 6F            DB      6F
xxxx:924E 7274          JB      92C4
```

The important line, namely the OR of AL with itself, is highlighted between rows of hyphens above, though these last will not, of course, appear in the DEBUG display. The line is used to set the condition flags to indicate whether a character has been seen. To ignore characters in the buffer, simply change the OR into an XOR (30 hex):

```
-e 923d
xxxx:923D 0A.30
```

If you now check the patch by issuing

```
-u 9230
```

the display will show the XOR instruction at offset :923D.

To save the modified version, issue

```
-w
```

(DEBUG will tell you it's writing 9AF7 bytes) and quit, with

```
-q
```

After testing the patched version, RE-Name it and you're in business. A typical batch file to recompile a few programs might look like this:

```
keyfake 'wprogram1' 13 'ocqcq'
turbo
keyfake 'wprogram2' 13 'ocqcq'
turbo
keyfake 'wprogram3' 13 'ocqcq'
turbo
```

Peter Heweston
Canberra, Australia

### MOVING FILES

The Turbo program shown in Figure 3 is designed to move the directory entry of a file from one subdirectory to another on the same disk without actually moving the file. Wildcard characters are not supported, however.

James L. Ellis
River Edge, New Jersey

*Moving a file using Mr. Ellis's procedure is almost instantaneous, regardless of the file's size. It certainly beats copying the file from one directory to another and then deleting the original. Turbo's own Rename procedure will accomplish the move, as in the procedure* Move_Dir2, *but Mr. Ellis's use of the MSDOS procedure illustrates some important points about calling DOS functions.*

*First, when a DOS function requires a string (e.g., a filename), a specific pair of registers will point to the segment and offset of the string in memory. The string has to be in ASCIIZ form, that is, just a series of characters ending with an ASCII zero. Since a Turbo string begins with a length byte and has no ASCII zero terminator, you must modify it before use with a DOS function. It's easy enough to add a chr(0) to the end of a Turbo string. To skip the length byte, you simply add 1 to the offset portion of the string's address.*

*Flags is an integer field in the register's data type, and the lowest bit of this integer (corresponding to the number 1) is the carry flag. On exiting most DOS functions, the carry flag is 0 if the operation was successful. Hence if Flags AND 1 = 1, the*

```
PROGRAM MoveDir;

TYPE
  CommandStr = STRING[127];
  Str80 = STRING[80];
  Registere = RECORD CASE Integer OF
    1 : (AX, BX, CX, DX, BP, SI, DI, DS, ES, FLAGS : Integer);
    2 : (AL, AH, BL, BH, CL, CH, DL, DH : Byte);
              END;
VAR
  OrgName, NewName : Str80;
  Error : Integer;


  PROCEDURE Move_Dir(VAR Orgn, Newn : Str80; VAR ER : Integer);
  VAR Rege : Registere;
  BEGIN
    WITH Rege DO
      BEGIN
        AH := $56;              { DOS function $56 }
        DS := Seg(Orgn);        { Address of original name }
        DX := Ofs(Orgn)+1;
        ES := Seg(NewN);        { Address of new name }
        DI := Ofs(NewN)+1;
        MsDos(Rege);
        IF Flags AND 1 = 1 THEN ER := AX
        ELSE ER := 0;
      END;
  END;

  PROCEDURE Move_Dir2(VAR Orgn, Newn : Str80; VAR ER : Integer);
    (* Uses Turbo's own "Rename" procedure to change a file's directory *)
  VAR F : file;
  BEGIN
    Assign(F,Orgn);
    {$I-} Rename(F,NewN); {$I+}
    ER := IOresult;
    (* See the turbo manual for interpretation of I/O errors *)
  END;

BEGIN
  IF ParamCount = 2 THEN
    BEGIN
      OrgName := ParamStr(1)+Chr(0);
      NewName := ParamStr(2)+Chr(0);
      Move_Dir2(OrgName, NewName, Error);
      CASE Error OF
        0 : WriteLn('Successfully moved ', OrgName, ' to ', NewName);
        2 : WriteLn('File not found.');
        3 : WriteLn('Path not found.');
        5 : WriteLn('File access denied.');
      ELSE WriteLn('ERROR #',Error);
      END;
    END
  ELSE WriteLn(87, 'Enter "MOVEDIR <oldpathname> <newpathname>"');
END.
```

**Figure 3:** *Using Turbo to move a file from one directory to another.*

## ■ TURBO POWER USER

*carry flag is not 0 and an error has occurred. In this case, the AX register contains the error code.*

*You can use the* `Move_Dir` *procedure within a program or use it as a utility after compiling the program. It requires two parameters: the original name and the new name/path. If you don't have such a utility,* `MOVEDIR` *will be very handy.*

### COLOR COMBOS

Figure 4 shows a handy routine (which I've labeled Color_Help) that displays all of the combinations of TextColor and TextBackground colors available in Turbo Pascal. The values for TextBackground can range from 0 to 8. TextColor values run from 0 to 15 for nonblinking characters and from 16 to 31 for blinking ones. Seeing the actual effects on the screen will help you select your own color combinations for your programs.

Kim Berggren
Minneapolis, Minnesota

■ Since a Turbo string begins with a length byte and has no ASCII zero terminator, you must modify it before use with a DOS function.

*The DOS color/attribute byte consists of background and foreground "nibbles." Each one of these nibbles is capable of representing numbers from 0 to 15. How does this relate to Turbo's 0..8 and 0..31? In Turbo, you add 16 to the TextColor to make it blink. In DOS, you add 8 to the background nibble. You'll find that this distinction is important when you write routines to "poke" character and attributes directly into video RAM.*

### MORE DRIVES FOR TURBO

The Turbo Pascal, Version 3.01A, ChDir procedure causes an I/O error if the drive designator is greater than Q:. This can be troublesome for installations whose LASTDRIVE is set to a higher letter. The comparison that enforces this limit is at address 2CA3. It checks the drive letter to see if it is greater than A + 0Fh (i.e., Q). We modified this instruction to allow drive letters up to Z inclusive.

Roger Rohweder/W.B. Malthouse
Washington, D.C.

*This patch is worthwhile even if you never use any drive letters beyond Q, for the change will affect all the programs you compile. To apply the patch, first make a copy of TURBO.COM, PC-DOS, Version 3.01A (never patch the original of any program!). Load it into DEBUG with the command*

```
DEBUG TURBO.COM
```

*At DEBUG's "-" prompt, enter the command* `U 2CA3`*. This will Unassemble the program starting with the instruction at offset 2CA3. The first instruction you see there should be* `CMP AL, 0F`*. (If it is not, you are patching the wrong version of Turbo—see below). Enter the command* `E 2CA4` *to let you enter bytes at offset 2CA4. The number* `0F.` *will appear. Type* `1B` *next to it and press Return. Repeat this process for address 3737 (i.e.,* `U 3737`*, then* `E 3738`*, changing 0F to 1B as before.) Enter* `W` *to write the patched program to disk and* `Q` *to quit. You have successfully patched Turbo Pascal. Your DEBUG session should look something like this:*

■ The ChDir procedure causes an I/O error if the drive designator is greater than Q:.

```
C:\TURBO>debug turbo.com
-u 2ce3
56F9:2CA3 3C0F      CMP     AL,0F
56F9:2CA5 73A7      JNB     2C4E
            . . .
-e 2ce4
56F9:2CA4  0F.1b
-u 3737
56F9:3737 3C0F      CMP     AL,0F
56F9:3739 770C      JA      3747
            . . .
-e 3738
56F9:3738  0F.1b
-w
Writing 9AF7 bytes
-q
```

*To patch the 8087 and BCD versions, follow the same procedure with different addresses. For TURBO-87.COM, Unassemble at addresses 2756 and 3200, and Enter the patch at 2757 and 3201. For TURBOBCD.COM, Unassemble at addresses 2BB1 and 3658, and Enter at 2BB2 and 3659.*

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```
PROGRAM Color_Help;
VAR
  Text, background : Integer;
BEGIN
  ClrScr;
  GoToXY(22, 3);
  WriteLn('TextColor/TextBeckground Settings');
  WriteLn;
  FOR Text := 0 TO 31 DO BEGIN
    FOR background := 1 TO 8 DO BEGIN
      TextColor(Text);
      TextBackground(beckground);
      Write(Text:2);
      Write('/');
      Write(background, ' ');
    END;
  END
END.
```

**Figure 4:** *A program that displays all the combinations of TextColor and TextBackground available in Turbo Pascal.*

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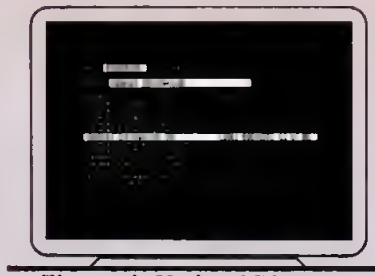

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CIRCLE 163 ON READER SERVICE CARD

■ PAUL SOMERSON

# USER-TO-USER

*Bypass diagnostic delays, protect your hard disk from damage, beat paper-out errors, share DOS global variables, and create a memory-size utility.*

## DIAGNOSTIC SHORTCUT

I recently had to use the IBM Diagnostics disk on my PC. Since the problem was elusive, I wanted to run multiple tests with errors logged to the printer. This led to two problems that were both solved by a single trick. The first problem arises because the disk drives are tested in every loop. I was certain that there was no problem in my disk drives, and the disk drive tests are time-consuming and put a lot of wear and tear on the drives. The second problem arises because the diagnostics do not provide a count of the number of loops that have been run.

The trick is to put write-protected disks in the disk drives. The diagnostics will quickly detect that a disk is write-protected, abort the test on that drive, send an error message to the printer, and move on to the next test. On a two-disk-drive machine, each loop will generate two write-protect errors and one disk drive error. You can determine the number of loops by counting the number of error sets.

The same effect can be achieved by putting no disks in the drives, but the diagnostics take much longer to decide that there is no disk in a drive than to decide that there is a write-protected disk in the drive.

Harold Brown
DeKalb, Illinois

*This technique makes it less traumatic to figure out what's wrong with your system. It was good of IBM to distribute diagnostic disks, but it should have included a decent section in the* Guide to Operations *explaining what all the tests do and what any reported error codes mean. And it should also have given you a real menu that lets you jump to the appropriate test rather than forcing you to wade through the whole routine.*

*But while the* GTO *is pathetic about defining errors, IBM's* Hardware Maintenance and Service *manuals are terrific. They tell you what tools you need, explain everything in absorbing detail, and flowchart you painlessly through the testing procedures. It's all clear and concise, and the manual is crammed with helpful illustrations. And you get a copy of the Advanced Diagnostics with it. It's such a deal.*

## HARD DISK WRITE PROTECTION

A recent User-to-User submission (Volume 5 Number 15) described a method to disable all access to the hard disk. The PROTECT.COM program created by PROTECT.BAS in Figure 1 or PROTECT.ASM in Figure 2 is a much better method. It simulates a write-protect tab by allowing read access but not write access to the hard disk (the floppy drives aren't affected). To apply the write-protect tab, just type PROTECT at the DOS prompt. Typing PROTECT again will alternately switch the protection off and on.

The first time the program runs, it grabs interrupt 13h so that it can monitor all re-

```
100 ' Program for creating PROTECT.COM -- by Tom Kihlken
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 13:FOR C=1 TO 17:READ A$:IF C<17 THEN 140
130 Z#=Z#+VAL(A$)
140 NEXT:NEXT:IF Z#=18272 THEN RESTORE:GOTO 170
150 PRINT "ERROR:  CHECK THE LAST NUMBER IN"
160 PRINT "EACH DATA STATEMENT--THEN REDO":END
170 FOR B=1 TO 13:FOR C=1 TO 16:READ A$:TTL=TTL+VAL("&H"+A$)
180 NEXT:READ S:IF S=TTL THEN 200
190 PRINT "DATA ERROR IN LINE";B*10+240;"-- CHECK AND REDO":END
200 TTL=0:NEXT:RESTORE
210 OPEN "PROTECT.COM" AS #1 LEN=1:FIELD #1,1 AS D$
220 FOR B=1 TO 13:FOR C=1 TO 16:READ A$:LSET D$=CHR$(VAL("&H"+A$))
230 PUT #1:NEXT:READ DUMMY$:NEXT:CLOSE
240 PRINT "PROTECT.COM CREATED":END
250 DATA EB,2D,90,00,00,00,00,0F,80,FC,03,74,0A,80,FC,05,1333
260 DATA 74,05,2E,FF,2E,03,01,2E,80,3E,07,01,00,75,F3,80,1204
270 DATA FA,00,74,EE,00,FA,01,74,E9,B4,03,F9,CA,02,00,BA,2154
280 DATA 08,01,8C,C8,8E,C0,48,8E,D8,8E,F2,8E,FA,89,04,00,2072
290 DATA FC,F3,A7,75,07,80,3E,07,01,0F,75,30,3D,01,00,75,1343
300 DATA E5,2E,C6,06,07,01,00,B8,13,35,CD,21,2E,89,1E,03,1197
310 DATA 01,2E,8C,06,05,01,8E,1F,BA,98,01,B4,09,CD,21,BA,1196
320 DATA 08,01,B8,13,25,CD,21,BA,2F,01,CD,27,F6,16,07,01,1241
330 DATA 80,3E,07,01,00,74,06,BA,B0,01,EB,04,90,EA,98,01,1485
340 DATA E4,09,8E,1F,CD,21,CD,20,48,61,72,64,20,44,69,73,1412
350 DATA 6E,20,50,72,6F,74,65,63,74,69,6F,6E,20,4F,6E,24,1459
360 DATA 48,61,72,64,20,44,69,73,6B,20,50,72,6F,74,65,63,1463
370 DATA 74,69,6F,6E,20,4F,66,66,24,00,00,00,00,00,00,00,793
```

**Figure 1:** *PROTECT.BAS program to create PROTECT.COM, a drive C: (and above) hard disk write-protect tab simulator.*

## ■ USER-TO-USER

quests for disk I/O. When a disk write operation is requested, the program checks to see if a fixed disk drive was selected. If so, the error code for write protection is returned and DOS displays its usual error message. All other disk accesses are allowed to proceed normally.

Once the program has been installed, it can turn itself off or on by searching through memory for the original copy and then resetting its switch. When the program is switched off, all disk operations are allowed to proceed normally.

Tom Kihlken
St. John, Missouri

*This works by allowing writes only to drives A: and B:. If you have a 3½-inch drive installed as D: or a RAMdisk as E:,*

## ■ PROTECT.COM simulates a write-protect tab by allowing read access but not write access to the hard disk (the floppy drives aren't affected).

*PROTECT will prevent you from writing to these as well. To adapt the program so that it can write to these drives but not to your hard disk, add the appropriate*

```
CMP     DL, 03H
JZ      CONTINUE
```

### LOW TECH

I recently purchased a new printer (NEC P-760) that kept shutting off by itself. The manufacturer first replaced the motherboard and then gave me a whole new machine, but the problem persisted.

I discovered that many printers have photocell paper-out indicators. The forms I was printing had a wide reverse line in black ink. When the photocell saw this, it assumed the paper had run out.

I covered the photocell with a sheet of paper, and it works perfectly.

Sydney H. Solomon, Lake Worth, Florida

```
; PROTECT.ASM -- RESIDENT WRITE PROTECT FOR HARD DISK
; ===================================================
CSEG            SEGMENT
                ASSUME CS:CSEG
                ORG     100H
;
START:          JMP     INITIALIZE
;
OLDINT13        DD      ?               ;ORIGINAL INTERRUPT 13 VECTOR
SWITCH          DB      0FH             ;ON/OFF SWITCH FOR PROTECTION
;
; NEW INTERRUPT 13 (BIOS DISK I/O)
; --------------------------------
NEWINT13        PROC    FAR
                CMP     AH, 03H         ;SEE IF DOING DISK WRITE
                JZ      CHECKSTAT       ;IF WRITING CHECK DRIVE NO.
;
                CMP     AH, 05H         ;SEE IF DOING DISK FORMAT
                JZ      CHECKSTAT       ;IF FORMATTING CHECK DRIVE NO.
;
CONTINUE:       JMP     CS:[OLDINT13]   ;ALLOW OPERATION TO PROCEED
;
CHECKSTAT:      CMP     SWITCH, 00H     ;IS PROTECT SWITCH ON
                JNZ     CONTINUE        ;IF NOT PROCEED
                CMP     DL, 00H         ;WAS FLOPPY 'A' SELECTED
                JZ      CONTINUE        ;IF YES, PROCEED
                CMP     DL, 01H         ;WAS FLOPPY 'B' SELECTED
                JZ      CONTINUE        ;IF YES, PROCEED
;
ABORT:          MOV     AH, 03H         ;SET WRITE PROTECT ERROR CODE
                STC                     ;SET FAILURE STATUS
                RET     2               ;RETURN WITH EXISTING FLAGS
;
NEWINT13        ENDP
;
; PROGRAM INSTALLATION
; BEGIN BY SEARCHING FOR AN EXISTING COPY OF CODE
; -----------------------------------------------
INITIALIZE:     MOV     DX, OFFSET NEWINT13  ;OFFSET TO BEGIN CODE SEARCH
                MOV     AX, CS          ;DS:SI POINTS TO DESTINATION
                MOV     ES, AX          ;ES:DI POINTS TO SOURCE
;
NEXTSEG:        DEC     AX              ;SEARCH PREVIOUS SEGMENT
                MOV     DS, AX          ;LOAD NEW SEGMENT TO SEARCH
                MOV     SI, DX          ;POINT TO BEGINNING OF STRING
                MOV     DI, DX          ;POINT TO BEGINNING OF STRING
; 4 WORDS MUST MATCH TO CONFIRM A COPY OF PROGRAM EXISTS
                MOV     CX, 0004H       ;FOUR WORDS MUST MATCH
                CLD                     ;CLEAR DF FOR AUTOINCREMENT
                REPE    CMPSW
                JNZ     NOTFOUND        ;IF NO MATCH, KEEP TRYING
; A LOCAL COPY OF THE PROGRAM MAY EXIST IN AN INPUT BUFFER
; ANY LOCAL COPIES MAY BE IDENTIFIED BY SWITCH SET TO 0FH
                CMP     DS:SWITCH, 0FH  ;IS THIS AN INSTALLED COPY
                JNZ     TOGGLESW        ;IF REAL COPY, TOGGLE SWITCH
NOTFOUND:       CMP     AX, 0001H       ;STOP SEARCHING AT LOW MEMORY
                JNZ     NEXTSEG
;
; IF WE DROP OUT OF LOOP WITHOUT FINDING CODE THEN WE MUST INSTALL IT
;
                MOV     SWITCH, 00H     ;SET SWITCH TO ON
                MOV     AX, 3513H       ;SETUP TO GET OLD VECTOR
                INT     21H
;
;  PUT OLD VECTOR IN MEMORY
                MOV     WORD PTR CS:[OLDINT13],   BX
                MOV     WORD PTR CS:[OLDINT13+2], ES
;
                PUSH    CS
                POP     DS              ;SET DS TO CS
;
; SEND MESSAGE, EXIT AND REMAIN RESIDENT
                MOV     DX, OFFSET PROTECT_ON
                MOV     AH, 09H         ;PRINT STRING FONCTION CALL
                INT     21H
;
; MAKE INTERRUPT 13 POINT TO THIS PROGRAM
                MOV     DX, OFFSET NEWINT13                    (continues)
```

**Figure 2:** *Assembler listing for PROTECT.COM.*

# Interlude II

## COWGIRL CAPER—Interlude # 125

Howdy, partner.

***Howdy, partner???***

You've got a date with a cowgirl tonight.

***Uh oh. Have you been playing Interlude again?***

Let's see...I'll need a hat, boots, chaps...and maybe spurs.

***What time does the rodeo start?***

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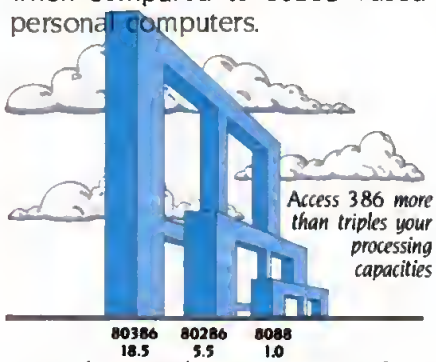


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CIRCLE 521 ON READER SERVICE CARD

## ■ USER-TO-USER

```
                MOV     AX, 2513H       ;SET NEW INTERRUPT 13
                INT     21H
;
                MOV     DX,OFFSET INITIALIZE ;NO. OF BYTES TO STAY
                INT     27H             ;TERMINATE AND STAY RESIDENT
;
;  IF PROGRAMS EXISTS IN MEMORY, THEN WE MUST ONLY TOGGLE THE SWITCH
TOGGLESW:       NOT     DS:SWITCH       ;DS SAS BEEN SET BY SEARCH
                CMP     DS:SWITCH, 00H  ;IS SWITCH ON
                JZ      ON
                MOV     DX, OFFSET PROTECT_OFF
                JMP     EXIT
ON:             MOV     DX, OFFSET PROTECT_ON
EXIT:           MOV     AH, 09H         ;PRINT STRING FUNCTION CALL
                PUSH    CS
                POP     DS              ;RESTORE DS
                INT     21H
                INT     20H             ;EXIT TO DOS
;
PROTECT_ON      DB      "Hard Disk Protection On$"
PROTECT_OFF     DB      "Hard Disk Protection Off$"
CSEG            ENDS
;
                END     START
```

*(Figure 2 ends)*

*We reported a similar problem several months ago, when a floppy disk manufacturer decided to be stylish and replace the drab old black write-protect tabs with deep maroon ones. Only trouble was the photocell wasn't sensitive to red and couldn't see the chic new tabs, which let users obliterate files they wanted protected.*

### GET SET

You can access the SET environment strings in batch files simply by putting the set name inside a pair of percent signs (%). This lets batch files use the environment as a global memory area. For example, with a subdirectory on drive A: called \DOS, type

```
SET DOIT=A:\DOS
```

Then create a batch file called D.BAT:

```
DIR %DOIT%
```

■ You can access the SET environment strings in batch files simply by putting the set name inside a pair of percent signs (%).

Typing D at the DOS prompt will display the directory listing for A:\DOS.

Mike Ober
Colorado Springs, Colorado

*SET has been around for a long time as an undocumented command, and from the pathetic description in the 3.x DOS manual, it might just as well still be undocumented. The above technique does work but just scratches the surface. By the way, you can see the current state of your environment, including all the variables you've set, by typing SET.*

### MEMORY CHECKER

With all the memory-resident programs and different ways that you can configure these programs—as well as your own system—with buffers, it would be nice to know how much available memory is left for your applications programs.

MEMORY.COM is a simple program that returns the current free RAM. To create MEMORY.COM, type in the MEMORY.SCR script in Figure 3 with a pure-ASCII word processor. Be sure to include the blank line after DB 0 and hit the Enter key after each line, especially the last one. Then from the DOS prompt type

```
DEBUG < MEMORY.SCR
```

You must have DOS 2.0 or later for MEMORY.COM.

Michael J. Mefford
Gleneden Beach, Oregon

*A quick and handy utility. Remember that MEMORY.COM reports bytes free in Ks (1024s), while CHKDSK reports them in 1000s.*

```
A
XOR     SX,BX
MOV     AH,4A
INT     21
MOV     AH,48
MOV     BX,FFFF
INT     21
MOV     AX,BX
XOR     DX,DX
MOV     CX,40
DIV     CX
CMP     DX,20
JB      11C
INC     AX
MOV     BX,AX
MOV     CX,64
CALL    139
MOV     CX,A
CALL    139
MOV     CX,1
CALL    139
MOV     DX,15C
MOV     AH,9
INT     21
INT     20
MOV     AX,BX
XOR     DX,DX
DIV     CX
MOV     BX,DX
MOV     DL,AL
CMP     AL,0
JZ      14B
OR      [15B],AL
CMP     BYTE PTR [15B],0
JA      153
RET
ADD     DL,30
MOV     AH,2
INT     21
RET
DB      0

E 15C "K Bytes free$"
RCX
69
N MEMORY.COM
W
Q
```

**Figure 3:** *MEMORY.SCR script that creates MEMORY.COM free-memory checking utility. Type this in using the DOS COPY CON command or a pure-ASCII word processor. Be sure to include the blank line after DB 0 and hit the Enter key after each line, especially the last one. Then, at the DOS prompt, type DEBUG < MEMORY.SCR.*

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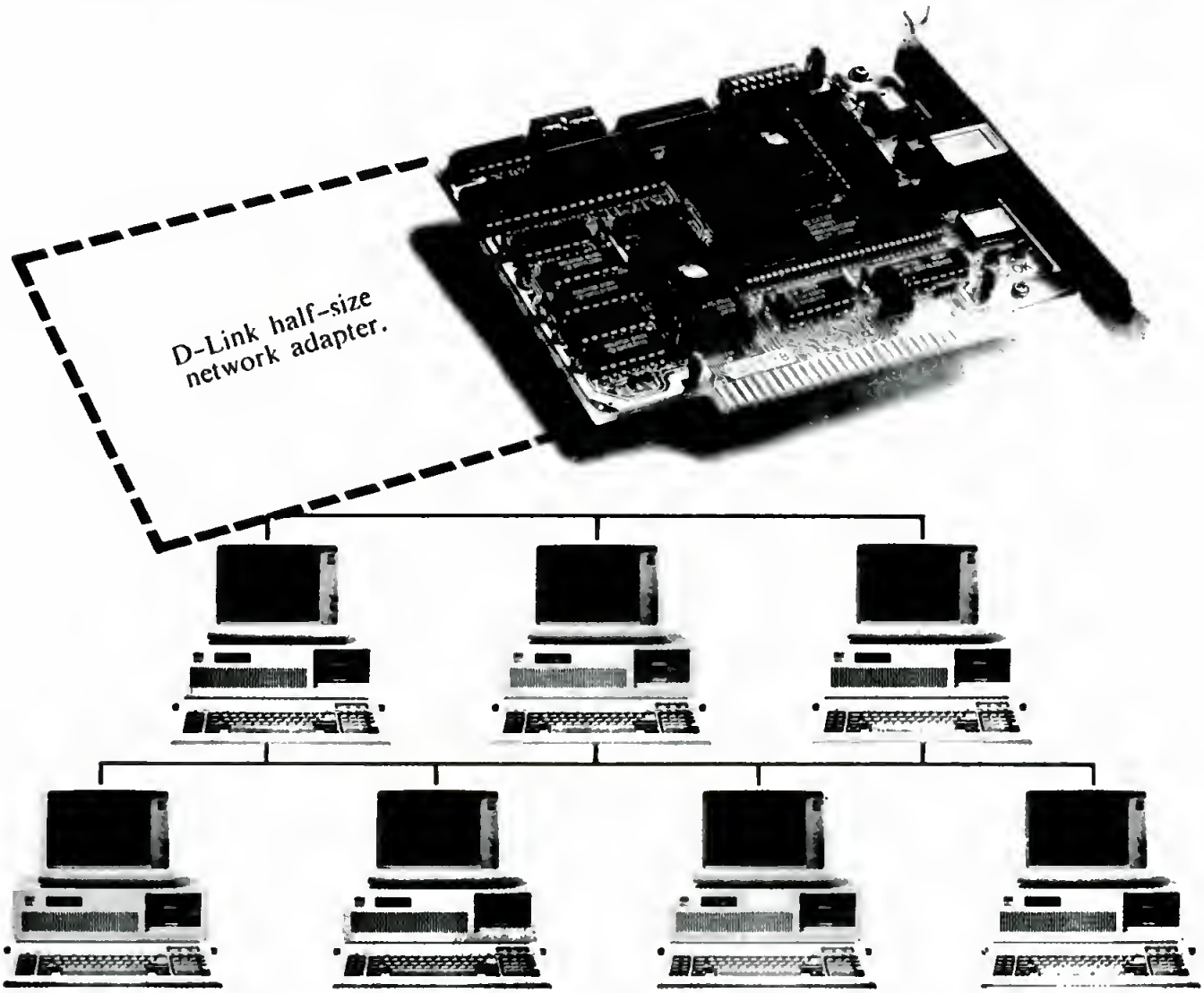


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CIRCLE 243 ON READER SERVICE CARD

■ CHARLES PETZOLD

# PC TUTOR

*How to change screen colors in Release 2 of 1-2-3; differences between PC and GW-BASIC; and understanding those mysterious .PIF files.*

## COLORS IN 1-2-3, RELEASE 2

Our department is a heavy user of Lotus's *1-2-3*, Release 1A. We would like to convert to Release 2, but we are unaware of a method to change the software to accept color modifications. Such information would be of great interest to all Release 2 users.

David A. Rampson
Fort Washington, Pennsylvania

*Color customization should be built into all large applications programs. You can't work productively if you're forced to look at an ugly screen.*

*Release 1A and Release 2 use similar methods to handle color in text modes. Internally,* 1-2-3 *uses only 16 color codes—0 through 15. When* 1-2-3 *needs to display something on the screen, it calls a routine in the display driver. The driver then translates the internal color code to the PC's 1-byte attribute code. It does this by means of a simple "color translation table," which is a string of 16 consecutive bytes that correspond to the internal* 1-2-3 *color codes.*

1-2-3 *internally uses a color code of 0 for normal text (for instance, spreadsheet entries), 1 for the spreadsheet border, 2 for highlighting in the Help and Status screens, 3 for the cursor in the Help screens, and so forth. So, the first four entries in the color translation table are the IBM display attributes that correspond to the colors* 1-2-3 *uses for these four items.*

*Patching display drivers in Release 1A was pretty easy because each type of display had a separate driver file with the extension .DRV. However, Release 2 uses a different approach. All the drivers are stored in a huge library file called INSTALL.LBR. When you select Install from the main menu and specify your hardware configuration, you create a .SET file that contains selected drivers from INSTALL.LBR. This .SET file has a default name of 123.SET, but may actually have any name you want.*

*Because of this driver library, it's more difficult to specify the exact addresses where the color translation table is located. INSTALL.LBR is too unwieldy to work with, and the 123.SET file will be different for every hardware configuration.*

*However, we can use DEBUG to search for the color translation table within the 123.SET file and then change some of the color codes. If you've installed* 1-2-3 *for an IBM Color Graphics Adapter, your spreadsheet entries should be white on a black background. The spreadsheet border should be black on a cyan background. The display attribute codes for these two colors are 07h for your entries and 30h for the borders. So, the color translation table will begin with these two values.*

■ Use DEBUG to search 123.SET for the color translation table and change some color codes.

*(Time out for a brief tutorial on display attribute codes: For IBM PC color displays, each character on the display has a corresponding 1-byte attribute code that specifies the color. In hexadecimal, each byte has 2 hexadecimal digits. The second digit is the foreground color—the color of the characters. These digits are:*

| | |
|---|---|
| *0: Black* | *8: Gray* |
| *1: Blue* | *9: Light Blue* |
| *2: Green* | *A: Light Green* |
| *3: Cyan* | *B: Light Cyan* |
| *4: Red* | *C: Light Red* |
| *5: Magenta* | *D: Light Magenta* |
| *6: Brown* | *E: Yellow* |
| *7: White* | *F: Bright White* |

*The first digit is the background color. For 0 through 7 these are the same as the foreground color in the table above. For 8 through F, it's the same background color as 0 through 7 except that the character blinks.)*

*So, let's begin. First, create a new .SET file you can experiment with:*

```
COPY 123.SET 123COLOR.SET
```

*and load 123COLOR.SET into DEBUG:*

```
DEBUG 123COLOR.SET
```

*Do a DEBUG R (Register) command and write down the 4-digit hexadecimal number following CX. This is the number of bytes in the 123COLOR.SET file. Now execute*

```
S 100 L cccc 07 30
```

## ■ PC TUTOR

*where cccc is the value of CX you wrote down above. This will search through the file and list the address where DEBUG finds the two bytes 07 and 30. This address should be the beginning of the color translation table and will be in the form*

```
xxxx:yyyy
```

*where xxxx and yyyy are 4-digit hexadecimal numbers. If you now enter*

```
D yyyy L 10
```

*where yyyy is the number from the S (Search) command, you'll see the 16 attribute codes. (If the Search command lists more than one address, you'll have to stop and figure out which one of them is the color table.)*

*You can now enter*

```
E yyyy
```

*followed by the new attribute codes you want to patch into the color translation table. For instance, if you want the spreadsheet entries to be yellow on blue and the spreadsheet border to be black on red, you would enter*

```
E yyyy 1E 40
```

*Now write out the file to disk and quit DEBUG by entering the two single-line commands*

```
W
Q
```

*You can use this modified driver set by executing*

```
LOTUS 123COLOR
```

*Otherwise, 1-2-3 will continue to use the 123.SET file. When you get something you like and don't feel like entering the name of the driver set when you execute LOTUS, you can just replace 123.SET with the modified 123COLOR.SET:*

```
DELETE 123.SET
RENAME 123COLOR.SET 123.SET
```

### CAN'T USE PC-DOS BASICA

I have an IBM-compatible computer, and when I run either the BASIC or BASICA programs that come with IBM's PC-DOS 3.1 I get a "Divide overflow" error. Can both of these programs be patched to run on my computer? Also, what are those mysterious BASIC.PIF and BASICA.PIF files that are included with PC-DOS?

Jeffrey W. Stewart
Redondo Beach, California

*As the avalanche of inexpensive PC compatibles allows more and more people to buy PCs, this is a question I suspect we'll be answering every few months or so.*

*Some manufacturers of PC compatibles license from Microsoft a version of MS-DOS configured for their machines. These manufacturers also usually ship a similarly configured GW-BASIC interpreter. This GW-BASIC interpreter is functionally very similar to the BASIC and BASICA interpreters included with PC-DOS.*

■ Among other things, the .PIF file tells *Windows* just how "well behaved" the program is.

*Other manufacturers of compatibles do not license MS-DOS or GW-BASIC from Microsoft. These makers supply (or expect you to buy) IBM's own PC-DOS. However, you cannot run the BASIC and BASICA programs included with PC-DOS on a non-IBM machine. That's because these programs work in conjunction with a BASIC interpreter encoded in a ROM chip found only in the IBM machines. This is one of the sacrifices you make when you buy a compatible instead of buying IBM.*

*(Actually I did receive a letter from someone with a compatible who was able to run the PC-DOS BASICA because his machine was equipped with something his dealer called "Tuiwun BASIC." I found this interesting. So might IBM's and Microsoft's legal departments.)*

*Microsoft sells a retail version of the GW-BASIC interpreter designed to run on the IBM PC and compatibles. The BASIC interpreter gets very close to the hardware, so it may or may not run on your compatible. Microsoft doesn't sell very many GW-BASICs at retail, however, because the program costs $350. But I've noticed that PC's Limited sells a GW-BASIC for $95. You may want to check that out.*

*If you want to do BASIC programming, you might do better with Microsoft's QuickBASIC 2.0. While not a BASIC interpreter, QuickBASIC has a better editor, compiles in memory (so it's very fast), and has a good debugging environment. It lists for $99.*

### WHAT IS A PIF?

*You also asked about those mysterious files with the extension .PIF included with PC-DOS. You may start seeing .PIF files included with other software products, particularly some applications from Microsoft, such as* Word *and* Access.

*PIF stands for "Program Information File." IBM invented the .PIF file for use with its* TopView *operating environment. Although* TopView *has pretty much bitten the dust, Microsoft has also used .PIF files for its* Windows *operating environment. (Both* TopView *and* Windows *are discussed in our cover story, "Operating in a New Environment,"* PC Magazine, *Volume 5 Number 4.)*

*There are several different kinds of programs you can run under* Microsoft Windows. *The first category is a "*Windows *application." This is a program specifically written for* Windows, *and it does not run under plain DOS. This category includes the utilities that come with* Windows *(Write, Paint, Clock, etc.) and a few programs from other manufacturers (such as Micrografx's* In*a*Vision *and* Windows Draw, *and* Palantir Filer *2.0).*

*Many normal programs that run under DOS can still run under* Windows, *however. These programs are called either "standard applications" or "old applications."*

*When you want to run an old application under* Windows, Windows *looks for a .PIF file with the name of that application. The .PIF file contains information about the program. Among other things, it tells* Windows *how much memory the application needs and just how "well behaved" the program is.*

***PROPER PROGRAMS*** *The "well behaved" criterion covers several items, but in most cases it comes down to the following question: Does the application write directly to the display memory? In the case*

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## ■ PC TUTOR

*of virtually all word processors, spreadsheets, and graphics programs, the answer is yes.* Windows *cannot run these programs in a window, and it cannot multitask them.* Windows *must give up the entire display because it has no way of knowing when the program will write to the screen.*

*A program that does not write directly to display memory (but instead goes through DOS or the BIOS to display something on the screen) can be run in a window, share the screen with other applications, and be multitasked.*

*These two categories of programs not designed to run under* Windows *are sometimes called "bad applications" (cannot be run in a window) and "good old applications" (can run in a window). The terms "good" and "bad" here denote only how the program uses the hardware of the PC and not how well the program works. Some of the best programs around are "bad applications" as far as* Windows *is concerned. Some of them are so bad they cannot be run under* Windows *at all. The "baddest" program of them all, for instance, is probably* SideKick.

Windows *also allows "good old applications" to be listed in the WIN.INI file so they don't need .PIF files. If you try to run an old application under* Windows *without a .PIF file,* Windows *will ask if you want to use the default .PIF settings, which assume that it's a "bad application."*

Windows *includes a program called PIFEDIT to create or modify .PIF files. The actual internal format of the .PIF file is documented in IBM's* TopView Programmer's Toolkit.

*The .PIF file is a convenient way for an advanced operating system to deal with programs written for the anarchic "anything goes" DOS environment. I wouldn't be at all surprised to see the .PIF file (or something like it) play an important role in a future version of DOS that supports the PC AT's 80286 microprocessor in protected mode.*

---

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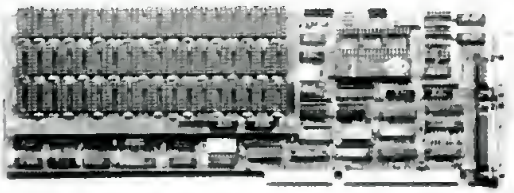

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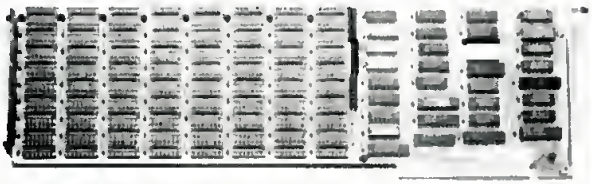

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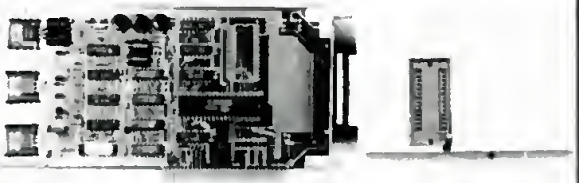

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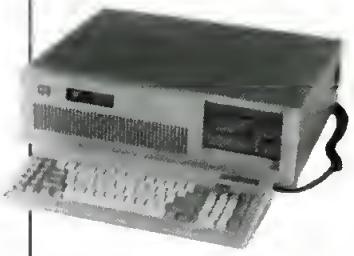

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| COMPAQ "286" DeskPro w/30 meg 512K tape | 3578.60 |
| COMPAQ "286" Portable 640K, 20M | 3860.30 |
| COMPAQ "286" Portable 640K 20M, tape | 4292.30 |
| COMPAQ "386" DeskPro New Model | SAVE |

### AT&T SPECIALS

| | |
|---|---|
| AT&T 6300 w/128K 1 drive | $1699.81 |
| AT&T 6300 w/256K 2 drives | 1849.24 |
| AT&T 6300 w/256K 1 floppy, 20 meg hard drive | 2174.23 |

All AT&Ts include monitor, keyboard and DOS

### TOSHIBA SPECIAL

| | |
|---|---|
| TOSHIBA 1100+, 3100 | SAVE |

### SHARP SPECIAL

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### NEC APC IV SPECIALS

| | |
|---|---|
| NEC APC IV, AT compatible, 1 2 Floppy | From $1950.00 |
| NEC APC IV, 20 meg hard drive | 2279.35 |
| NEC APC IV, 40 meg hard drive | 2595.15 |
| NEC APC IV, 70 meg hard drive | 3197.65 |

### WYSE PC SPECIALS

| | |
|---|---|
| WYSE PC 1 drive | $989.68 |
| WYSE PC 1 drive 20 meg | 1320.48 |
| WYSE PC 1 drive 40 meg | 1779.70 |

### ZENITH SPECIALS

| | |
|---|---|
| ZS-158 1 drive 256K 5 slots w/DOS | $1263.60 |
| ZS-171 Laptop 2 drives 256K 15 lbs | 1684.80 |
| ZS-181 Laptop two 3½" floppies | SAVE |
| ZS-241 512K 1.2 meg floppy, AT Compat | 2457.00 |

Other Computers Available Upon Request

## TERMINALS

### KIMTRON

| | |
|---|---|
| 14" Green or Amber w/AT keyboard | $449.07 |
| 12" Green or Amber w/AT keyboard | 399.60 |

### WYSE

| | |
|---|---|
| WY-30 14" emulates ADDS and Televideo | $289.10 |
| WY-50 14" Green emulates ADDS, Hazeltine and Televideo | 429.44 |
| WY-50+ Amber multi-unit emulation | 479.20 |

## TAPES AND DRIVES FOR IBM ATs

| | |
|---|---|
| SEAGATE 30 meg hard disk | $550.80 |
| SEAGATE 60 meg hard disk | 1189.78 |
| 360K floppy drive | 110.12 |
| GENOA 20 meg internal tape | 588.82 |
| GENOA 20 meg external tape | 636.02 |

## PRINTERS

SPECIAL—LIMITED QUANTITIES
EPSON LQ 1500 with Tractor ..... 749.00

| | |
|---|---|
| CITIZEN MSP10 | $275.20 |
| CITIZEN MSP20 | 334.92 |
| EPSON LX 86 80 Col 100 CPS HLQ STD | 299.61 |
| EPSON EX 1000 | 605.56 |
| EPSON EX 800 | 466.76 |
| EPSON FX 85 | 358.60 |
| EPSON FX 286 | 479.19 |
| EPSON LQ 800 | 499.22 |
| EPSON LQ 1000 | 722.55 |
| EPSON LQ 2500 | 1018.44 |
| EPSON RX 100 | 289.90 |
| EPSON COMREX 420 132 Col. 420 CPS | 899.99 |
| IBM Pro Printer | 429.40 |
| IBM Pro Printer XL | 542.67 |
| NEC P6 80 col | 449.22 |
| NEC P7 136 col 216 cps | 615.35 |
| NEC P5 136 col 290 cps | 999.67 |
| NEC 3550 Spiewriter | 797.12 |
| NEC 8850 Spiewriter | 1127.85 |
| OKI okimate 20 | 117.72 |
| OKI ML 182 | 234.50 |
| OKI ML 192 Plus | 344.80 |
| OKI ML 193 Plus | 519.40 |
| OKI ML 292 Plus | 424.44 |
| OKI ML 293 Plus | 547.55 |
| TOSHIBA P321 | 463.25 |
| TOSHIBA P341 | 558.80 |
| TOSHIBA P351 S/P | 999.06 |

## LASER PRINTERS

| | |
|---|---|
| CORDNA Laser Printer | 2125.90 |
| H-P Laser Jet Printer | 2289.60 |
| H-P Laser Jet Plus | 2994.20 |
| H-P Laser Jet 500 Plus | 3687.19 |
| QUAD Laser | 2859.30 |

## PLOTTERS

| | |
|---|---|
| HEWLETT PACKARD HP7440A | 969.20 |
| HEWLETT PACKARD HP7475A | 1398.95 |
| HOUSTON INSTRUMENTS DMP-42 | 2355.93 |
| HOUSTON INSTRUMENTS DMP-52 | 3356.93 |
| HOUSTON INSTRUMENTS DMP-52MP | 3787.70 |
| HOUSTON INSTRUMENTS DMP-56 | 4288.43 |

## FLOPPY & HARD DISK DRIVES

| | |
|---|---|
| 1/2 height drive | $98.00 |
| IBM Logo Drive | 99.73 |
| TANDON full height floppy drive | 109.57 |
| SEAGATE 20 meg 1/2 height hard drive | 379.00 |
| SEAGATE 30 meg full height w/controller | 659.50 |
| SEAGATE 30 meg 1/2 height w/ADAPTEC | 429.72 |
| GENOA 20 meg internal tape | 588.82 |
| GENOA 20 meg external tape | 636.02 |
| GENOA 60 meg tape drives | CALL |
| IOMEGA BERNOULLI 10+10 | 1798.40 |
| IOMEGA BERNOULLI 20+20 | 2175.65 |
| IRWIN 10 meg tape backup | 399.00 |

## DRIVE CARDS

| | |
|---|---|
| MOUNTAIN 20 meg | $659.88 |
| MOUNTAIN 30 meg | 899.45 |
| MAYNARD 20 meg | 683.45 |
| WESTERN DIGITAL 10 and 20 meg | CALL |

Plus Other Drive Cards Available

## MODEMS, COMMUNICATIONS & EMULATIONS

| | |
|---|---|
| AST 5251-11 Plus | $639.04 |
| AST 5251-12 | 508.60 |
| EVEREX 1200B | 119.50 |
| HAYES 1200 | 392.06 |
| HAYES 1200B | 299.03 |
| HAYES 2400 | 575.00 |
| HAYES 2400B | 499.18 |
| IRMA 5250 (Smartalec) | 564.84 |
| IRMA 3278/79 Courier | 749.60 |
| US ROBOTICS Password 1200 | 228.85 |
| US ROBOTICS Microlink 2400 | 424.15 |
| US ROBOTICS Courier 1200 | 429.60 |
| VEN-TEL 1200 Courier | 314.80 |
| VEN-TEL 1200B | 314.80 |

## MONOCHROME MONITORS

| | |
|---|---|
| AMDEK 310A | $139.99 |
| COMPAQ monochrome monitor (green or amber) | 188.46 |
| IBM monochrome monitor | 219.84 |
| PGS MAX 12E amber color | 167.40 |
| MAGNAVOX Green or Amber | 99.95 |
| TAXAN 123 Green | SAVE |
| TAXAN 124 Amber | SAVE |

## MONITOR INTERFACE CARDS

| | |
|---|---|
| CDW color card w/p | $ 99.00 |
| CDW monographics card w/p | 99.00 |
| GENOA Spectrum (color monographic w/p) | 199.82 |
| HERCULES color card w/p | 144.16 |
| HERCULES monographics plus w/p | 179.84 |
| STB chauffeur w/p | 199.60 |

## COLOR GRAPHIC MONITORS

| | |
|---|---|
| AMDEK color 600 (Hi-Res RGB) | $399.97 |
| AMDEK color 722 | 499.78 |
| IBM color monitor | 528.77 |
| MAGNAVOX 14" RGB 640 x 200 | 289.00 |
| PGS HX-12 Hi-Resolution RGB | 412.32 |
| NEC Multisync | 589.04 |
| TAXAN 720 | SAVE |

## ENHANCED GRAPHICS PRODUCTS (EGA)

| | |
|---|---|
| COMPAQ enhanced graphics monitor | SAVE |
| GENOA Spectra EGA 256K w/p | 287.60 |
| IBM enhanced graphics monitor | 679.41 |
| PARADISE Auto Switch EGA | 370.70 |
| PGS HX-12E Hi-Resolution RGB | 484.32 |
| QUADRAM EGA Card | 347.73 |
| ORCHID EGA | 329.94 |
| TAXAN 760 New EGA Model | 499.00 |

## INTERFACE CARDS & MULTI-FUNCTION CARDS

| | |
|---|---|
| APPARAT 64/384K w/Clock | $99.89 |
| AST 8 pack with 64K C/S/P expands to 384K | 166.24 |
| AST PREMIUM 6 pack 512K expands to 1 meg 2 ser 1 para game and clock | 364.25 |
| AST advantage for AT expands to 3 meg | 345.00 |
| AST I/O mini (clock/serial port) | 125.28 |
| INTEL above board for PC w/64K | 279.60 |
| INTEL above board for AT w/128K | 360.24 |
| JRAM-3 w/256K (Lotus 2.0 and Symphony compatible) | 360.24 |
| Parallel Port | 89.80 |
| QUADRAM Liberty w/64K | 245.41 |
| QUAD AT expands to 2 Meg | 325.43 |
| QUADRAM Quad Board expands to 384K 1 par., 1 ser., 1 game clock w/0K | 119.60 |
| QUADRAM Silver Quad expands to 384K 1 par., 2 ser., 1 game, clock w/0K | 119.80 |
| Serial Port | 49.95 |
| ZUCKERBOARD expands to 576K w/0K/c | 89.95 |

## SOFTWARE

| | |
|---|---|
| dBASE III Plus | $399.60 |
| FRAMEWORK II | 399.40 |
| LOTUS 1-2-3 New Release | 299.00 |
| LOTUS Symphony | 429.30 |
| MICROSOFT WORD 3.0 | 267.00 |
| SYMANTEC Q & A | 229.59 |
| WORDPERFECT 4.2 | 219.54 |

## CHIPS

| | |
|---|---|
| 4164 (64K 150 nanoseconds) | $2.00 |
| Nine Chip Set (complete set) | 9.99 |
| 128K piggy backs for AT | 4.94 |
| Nine Chip Set (complete set) | 34.50 |
| 8087-2 (for COMPAQ DeskPro) | 149.33 |
| 8087-3 (for PC/XT/COMPAQ portable) | 121.50 |
| 80287-3 (for AT and AT Compatible) | 168.30 |
| 41256K (256K chips) | 4.00 |
| Nine Chip Set (complete set) | 28.12 |

## MISC. & ACCESSORIES

| | |
|---|---|
| A-B Switching Box (par. or serial) | $45.00 |
| BASF D/S, D/D | 12.50 |
| BASF 3.5" Disk for MACINTOSH 10 pack | 19.99 |
| BASF Disks for AT (1.2 meg) | 28.14 |
| CH PRODUCTS game ports | 37.42 |
| KENSINGTON Masterpiece | 99.99 |
| KENSINGTON Masterpiece + | 119.40 |
| KEYTRONICS 5150 | 99.00 |
| KEYTRONICS 5151 PC or AT&T | 192.00 |
| MICROSOFT Mouse (Bus Version) | 119.34 |
| MICROSOFT Mouse (Serial Version) | 131.26 |
| QUADRAM Micro Fazers | 140.40 |
| Printer Cable for IBM | 19.99 |
| XT Power Supply 150 Watt | 79.40 |

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| 2 Drives, 256K, Color Monitor | *$1425* |
| 1 Drive, 256K, 10 MB Monochrome Monitor | *$1535* |
| 1 Drive, 256K, 20 MB Monochrome Monitor | *$1545* |

## IBM XT

| | |
|---|---|
| 1 Drive, 640K, 20 MB Monochrome Monitor | *$2250* |
| 1 Drive, 640K, 20 MB Color Monitor | *$2450* |

## XT 286

| | |
|---|---|
| 1 Drive, 512K, 20 MB 6 Megahurtz Monochrome | *$3295* |
| Color | *$3495* |

## IBM AT

| | |
|---|---|
| 1.2 Floppy, 512K, 20 MB Monochrome Monitor | *$2895* |
| 1.2 Floppy, 512K, 20 MB Color Monitor | *$3095* |
| 30 MB | add *$280* |

## AT 339

| | |
|---|---|
| 1.2 Floppy, 512K, 30 MB 8 Megahurtz Enchanced Keyboard | *$4185* |

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### COMPAQ PORTABLE

| | |
|---|---|
| 2 Drives, 256K | *$1595* |
| 1 Drive, 256K, 20 MB | *$1999* |
| 1 Drive, 640K, 20 MB | *$2140* |

### COMPAQ DESK PRO

| | |
|---|---|
| 1 Drive, 640K, 20 MB Green or Amber Monitor | *$2195* |

### COMPAQ 286

| | |
|---|---|
| DESKTOP — 1 Drive 640K, 30 MB, Monitor | *$3250* |
| PORTABLE — 1 Drive 640K, 20 MB | *$3795* |

### COMPAQ 386

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## DRIVES & TAPES

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|---|---|
| 360K Floppy for PC | $99 |
| 360K Floppy for AT | $115 |
| 10MB Tape Backup for XT | $389 |
| 20MB Tape Backup for XT | $479 |
| 20MB Tape Backup for AT | $489 |

***EVEREX***

| | |
|---|---|
| 60MB Internal Backup for AT | $799 |
| 60MB External Backup for AT | $899 |

***SEAGATE HARD DISKS***

| | |
|---|---|
| 10MB Kit for XT (Model 213) | $369 |
| 20MB Kit for XT (Model 225) | $379 |
| 30MB Kit for XT (Model 238) | $469 |
| 30MB for AT (Model 4038) | $569 |
| 40MB for AT (Model 4051) | $699 |
| 80MB for AT | $1025 |

***IOMEGA***

| | |
|---|---|
| 10 + 10 Bernoulli w/Controller | $1875 |
| 20 + 20 Bernoulli w/Controller | $2425 |

## VIDEO BOARDS

| | |
|---|---|
| Hercules Graphics Plus | $189 |
| Hercules Graphics Card | $179 |
| Hercules Color Card | $145 |
| Sigma Color 400 | $395 |
| STB EGA Plus | $269 |
| Paradise Autoswitch | $355 |
| Quad EGA | $359 |
| Orchid Turbo EGA | $575 |
| Everex EGA | $249 |
| Everex Edge | $219 |
| Hercules Compatible Graphics Card | $85 |
| Hercules Compatible Color Card | $69 |

## MONITORS

| *AMDEK* | | *PRINCETON* | |
|---|---|---|---|
| 310A | $145 | MAX12 | $159 |
| 600 | $395 | HX12 | $415 |
| 722 | $499 | HX12E | $505 |
| | | SR12 | $565 |

| | |
|---|---|
| NEC Multisync | $579 |
| Thompson Color | $319 |


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| PARADISE AUTOSWITCH $355 | EVEREX 300/1200 MODEM W/SOFTWARE $125 | THOMPSON RGB COLOR MONITOR $319 | SEAGATE 20MB HARD DISK KIT $379 |

## PRINTERS

### EPSON

| | | | |
|---|---|---|---|
| LX 86 | $225 | LQ 1000 | $699 |
| FX 85 | $349 | LQ 2500 | $1025 |
| FX 286 | $469 | EX 800 | $475 |
| LQ 800 | $499 | EX 1000 | $699 |

### OKIDATA

| | |
|---|---|
| 192 | $319 |
| 193 PLUS | $509 |
| 292 W/MODULE | $525 |
| 293 W/MODULE | $679 |
| PACEMARK | $1749 |

### TOSHIBA

| | |
|---|---|
| 321 | $469 |
| 351 | $969 |

### NEC

| | |
|---|---|
| P6 | $459 |
| 3550 | $795 |
| P5XL | $1150 |
| P7 | $639 |

### IBM

| | |
|---|---|
| PROPRINTER | $399 |
| PROPRINTER XL | $549 |

### HEWLETT-PACKARD

| | |
|---|---|
| LASERJET | $2295 |
| LASERJET PLUS | $3050 |

### SILVER-REED

| | |
|---|---|
| EXP800 | $669 |

## SOFTWARE

| | |
|---|---|
| LOTUS 123 | $325 |
| SYMPHONY | $429 |
| WORD PERFECT 4.1 | $205 |
| WORDSTAR 2000+ | $279 |
| MULTIMATE ADV | $285 |
| MICROSOFT WORD | $259 |
| FRAMEWORK | $399 |
| D BASE III PLUS | $399 |
| R BASE SYSTEM V | $389 |
| VOLKSWRITER III | $145 |
| ENABLE | $349 |
| HARVARD TOTAL PROJ. MGR. | $289 |
| SMARTCOM | $79 |
| CROSSTALK | $99 |
| NORTON UTILITIES | $59 |

## MODEMS

### HAYES

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|---|---|
| 1200 | $355 |
| 1200 B ALONE | $289 |
| 1200 B W/SOFTWARE | $325 |
| 2400 | $545 |
| 2400 B | $489 |
| EVEREX 300/1200 W/SOFTWARE | $125 |

## MULTIFUNCTION BOARDS

| | |
|---|---|
| EVEREX MAGICARD 384K | $159 |
| AST 6 PACK W/384K | $189 |
| AST 6 PACK PREMIUM W/512K | $339 |
| AST ADVANTAGE | $339 |
| AST RAMPAGE PC W/256K | $259 |
| AST RAMPAGE AT W/512K | $425 |
| ORCHID TINY TURBO | $459 |
| INTEL ABOVE BOARD PC | $269 |
| INTEL ABOVE BOARD PC P/S | $299 |
| INTEL ABOVE BOARD AT | $359 |
| INTEL ABOVE BOARD AT P/S | $409 |
| IRMA BOARD | $759 |
| AST 5251-11 | $569 |

## CHIPS

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|---|---|
| 64K RAM CHIPS | 9 FOR $11 |
| 256K CHIPS | EACH $2.75 |
| 8087-3 | $109 |
| 8087-2 | $149 |
| 80287 | $175 |
| 80287-8MH2 | $269 |

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| MICROSOFT BUS MOUSE $119 | MOUSE SYSTEMS MOUSE $106 | EPSON PRINTER STAND W/PRINTER PURCHASE $15 | KEYTRONICS KEYBOARD $99 | KENSINGTON MASTERPIECE $89 |
| MICROSOFT SERIAL MOUSE $129 | 135 WATT POWER SUPPLY $95 | TILT SWIVEL MONITOR STAND $39 | KEYTRONICS ENHANCED KEYBOARD $165 | KENSINGTON MASTERPIECE PLUS $129 |


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| Cornerstone | 99.95 |
| Crosstalk | 92.00 |
| Crossword Magic | 28.95 |
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| dBase III+ | 419.95 |
| Deadline | 27.95 |
| Deadline Manager | 104.95 |
| Decision in Desert | 27.95 |
| dGraph III | 136.00 |
| Diagrammaster | 225.00 |
| Disk Drive Analyzer | 21.95 |
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| Easy | 97.50 |
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| Executive Sups | 27.95 |
| Executive Writer | 48.95 |
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| Fontrix Utility Pak | 20.95 |
| Fontpaks 1 thru 12 | ea. 12.00 |
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| Fortran Compiler | 244.95 |
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| Goldfinger | 27.95 |
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| Graphics Expander | 22.95 |
| Graphics Magician | 19.95 |
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| Nutshell | 95.95 |
| Nutshell Info Filer | 134.95 |
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| Pinball Construction | 21.25 |
| Pitfall II | 27.95 |
| Pitstop II | 23.50 |
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| Print Shop Gr. 1 or 2 | 19.95 |
| Print Shop Refill | 12.25 |
| Probase | 244.95 |
| Prokey 4.0 | 95.95 |
| Quick Basic | 95.95 |
| QuickCode 1-2-3 | 95.95 |
| QuickCode III | 136.00 |
| Quicken | 41.95 |
| Qwiknet 2.5 500 | 549.95 |
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| Rendez. w/Rama | 22.75 |
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| Ret. System 4-1-1 | 104.95 |
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| Rogue | 20.95 |
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| Sargon III | 27.25 |
| Sat (Harcourt Brace) | 45.00 |
| Sat (Barron's) | 53.00 |
| Select Write WP 101 | 95.95 |
| Seven Cities of Gold | 26.45 |
| Sidekick protected | 26.00 |
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| State of the Art | |
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| SuperCalc 3 | 239.95 |
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| Think Tank | 95.95 |
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| Transylvania | 12.95 |
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| True Basic | 84.00 |
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| Turbo Tutor | 22.95 |
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| Type! | 29.95 |
| Typefaces | 67.95 |
| Typing Tutor III | 29.95 |
| Ultima III | 35.49 |
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| Volkswriter Deluxe 2 | 141.00 |
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| Websters Spell Checker | 39.95 |
| Websters Thesaurus | 48.95 |
| Websters Writer | CALL |
| Windows | 95.95 |
| Will Writer | 27.95 |
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| HARDWARE | |
| Accelerator Board | 679.95 |
| Captain Board (384K) | 229.00 |
| Compuserve Starter | 21.95 |
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| Flip-n-File | 10.95 |
| Gamecard PC or AT | 39.26 |
| Gamecard w/Y-Cable | 49.95 |
| Hercules Color Card | 189.95 |
| Graphics Pak | 534.95 |
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Computer Type _____ SHIPPING

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Add $3.00 shipping, $4.95 in Hawaii and Alaska. MasterCard, Visa accepted. Personal checks allow 2 weeks. 5.5% sales tax for Ohio residents. Returns accepted within 30 days. 20% restocking fee is not replaced with same item. Compatibility not guaranteed.

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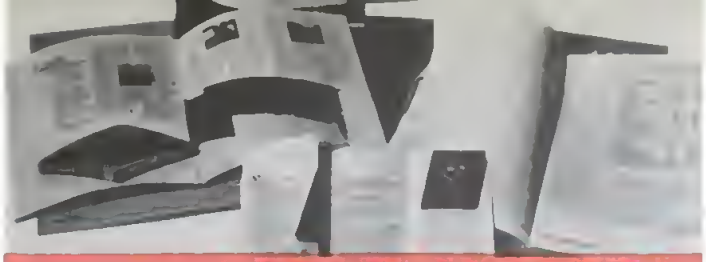

# FREE INFORMATION

## About Products & Services In this Issue!

Here's your chance to have all the facts, figures, and specifications about the products or services advertised or mentioned in this issue of PC Magazine. Absolutely free of charge!

Just complete the attached card. We'll notify the manufacturers or distributors so you can receive your free brochures directly from them.

## READER SERVICE CARD

**It's as easy as 1, 2, 3 to have valuable information about dozens of products right at your fingertips:**

**1** Fill in your name and address and check off your answers to the three research questions. (One card per person, please.)

**2** Circle the numbers on the card that correspond to the ads or articles you'd like more information about. (Numbers for advertised products are repeated in the Advertiser Index as well.)

**3** Mail the card today...it's postage paid. The literature will be mailed free of charge to your attention.

**1) For which of the following products are you involved in selecting brands/ models to be bought by your company or organization? (check all that apply)**

***Hardware***

a ☐ Mainframe
b ☐ Mini
c ☐ PC
d ☐ Printers/ Plotters
e ☐ Monitors
f ☐ Terminals
g ☐ Modems
h ☐ Hard Disk/Tape Back-up
i ☐ Add-in Boards
j ☐ LANS
k ☐ Micro-Mainframe Links

***Software***

l ☐ Communications
m ☐ Accounting
n ☐ Spreadsheets/ Financial Planners
o ☐ Project Managers
p ☐ Word Processors
q ☐ Database Managers
r ☐ Graphics

**2) Your primary job function is (check)**

s ☐ Administrative/ General Management
t ☐ MIS/DP, Communications Systems, Programming
u ☐ Engineering/R&D
v ☐ Finance/Accounting
w ☐ Marketing/Sales

**3) Next step after information is received:**

x ☐ Purchase Order
y ☐ Evaluation
z ☐ Specification/ Recommendation

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| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
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| 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 |
| 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 |
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| 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 276 | 279 | 260 |
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| 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 |
| 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 |
| 381 | 382 | 383 | 384 | 385 | 386 | 387 | 386 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 |
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| 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 462 | 453 | 454 | 455 | 456 | 457 | 456 | 459 | 460 |
| 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 476 | 479 | 460 |
| 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 |
| 501 | 502 | 503 | 504 | 506 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 613 | 514 | 516 | 516 | 517 | 616 | 519 | 520 |
| 521 | 522 | 523 | 524 | 525 | 526 | 527 | 526 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 |
| 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 564 | 555 | 556 | 557 | 558 | 559 | 560 |
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| 581 | 582 | 583 | 584 | 585 | 586 | 587 | 586 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 |
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| 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 676 | 676 | 677 | 676 | 679 | 680 |
| 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 |

PC1/13-2


**1) For which of the following products are you involved in selecting brands/ models to be bought by your company or organization? (check all that apply)**

***Hardware***

a ☐ Mainframe
b ☐ Mini
c ☐ PC
d ☐ Printers/ Plotters
e ☐ Monitors
f ☐ Terminals
g ☐ Modems
h ☐ Hard Disk/Tape Back-up
i ☐ Add-in Boards
j ☐ LANS
k ☐ Micro-Mainframe Links

***Software***

l ☐ Communications
m ☐ Accounting
n ☐ Spreadsheets/ Financial Planners
o ☐ Project Managers
p ☐ Word Processors
q ☐ Database Managers
r ☐ Graphics

**2) Your primary job function is (check)**

s ☐ Administrative/ General Management
t ☐ MIS/DP, Communications Systems Programming
u ☐ Engineering/R&D
v ☐ Finance/Accounting
w ☐ Marketing/Sales

**3) Next step after information is received:**

x ☐ Purchase Order
y ☐ Evaluation
z ☐ Specification/ Recommendation

PLEASE PRINT CLEARLY—use only one card per person

Name _____ Phone No (___)_____

Company _____ Title _____

Address _____ Apt _____

City _____ State _____ Zip _____
(Zip code must be included to insure delivery)


**CIRCLE FOR FREE INFORMATION** **Void after April 15, 1987**

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| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 116 | 119 | 120 |
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| 461 | 462 | 463 | 464 | 465 | 466 | 467 | 466 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 476 | 479 | 480 |
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| 501 | 502 | 503 | 504 | 505 | 506 | 507 | 506 | 509 | 510 | 511 | 612 | 613 | 514 | 515 | 516 | 517 | 616 | 519 | 520 |
| 521 | 522 | 523 | 524 | 525 | 526 | 527 | 526 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 536 | 539 | 540 |
| 541 | 542 | 543 | 544 | 545 | 546 | 547 | 546 | 549 | 550 | 551 | 562 | 553 | 554 | 556 | 556 | 557 | 558 | 559 | 560 |
| 561 | 562 | 563 | 564 | 565 | 566 | 567 | 566 | 569 | 570 | 571 | 672 | 573 | 674 | 675 | 576 | 577 | 676 | 579 | 580 |
| 581 | 582 | 583 | 584 | 585 | 586 | 587 | 586 | 589 | 590 | 591 | 592 | 593 | 694 | 695 | 596 | 597 | 598 | 599 | 600 |
| 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 616 | 619 | 620 |
| 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 |
| 641 | 642 | 643 | 644 | 645 | 648 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 |
| 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 676 | 679 | 680 |
| 681 | 682 | 683 | 664 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 |

PC1/13-1

## HOW TO STAY ON TOP OF WHAT'S WHAT IN THE PC MARKET

Are you frequently called upon to give advice about PC products? Is it your responsibility to make PC hardware, software and peripherals selections?

If so, there are probably products or services in this issue you wish you knew a little more about.

Well, all you have to do is send in your PC Magazine reader service card. You just circle the number that corresponds to the ad or article that interested you. We'll forward your name to the manufacturers or distributors so they can send you the literature you need.

Don't waste a minute. The sooner you fill out your card and send it in, the sooner you can start building your product reference file!

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# THE BIG BOOK BY ANY MEASURE.

# WHEN ONE MAGAZINE IS BOTH BIGGEST AND FASTEST GROWING,

# THERE HAS TO BE A REASON.

# 375,000

In the PC/MS-DOS market, there's no shortage of confusion. But one thing is perfectly clear:

PC Magazine has both the largest and fastest growing circulation of any publication.

Its circulation of 375,000 is up 25% from 1986—and moving fast.

PC Magazine is growing so sharply in both subscribers and newsstand sales because it provides a unique response to PC buyers' most pressing need— comprehensive and reliable product reviews.

PC Magazine's readers are brand specifiers, technically knowledgeable people who are charged by their companies and organizations with making specific product choices. They call the shots when it comes to buying.

They know better than anyone that although the microcomputer industry gives birth to many superb products, it also produces a raft of indistinguishables, and noncompatibles. Their job—should they wish to keep it—is to tell the difference.

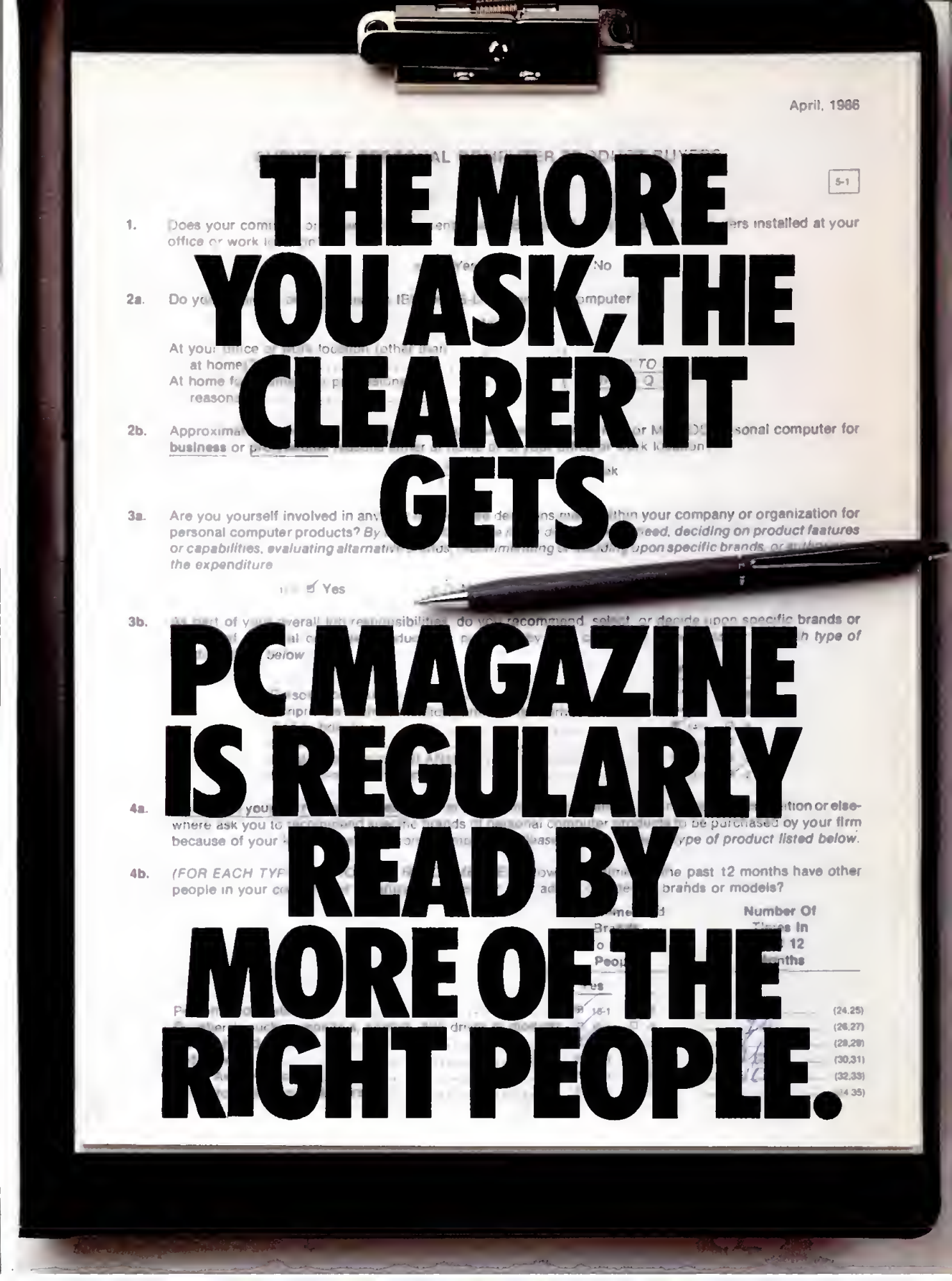
PC Magazine has reduced the risks for its readers by taking on the grueling task of creating benchmarks and new testing methodologies and applying them to products in side-by-side comparisons. It's expensive, time-consuming and risky—and well worth the effort.

Helping readers find their way through the tangle of PC products is what we do best. Readers have responded by making us the biggest book in the field, offering advertisers the broadest coverage of the growing PC/MS-DOS market—and at the lowest cost per reader.

If you're an advertiser in this market, check out our figures. You won't find better anywhere.

PC MAGAZINE

**THE BIG BOOK BY ANY MEASURE.**


April, 1986
THE MORE YOU ASK, THE CLEARER IT GETS.
PC MAGAZINE IS REGULARLY READ BY MORE OF THE RIGHT PEOPLE.

The research is coming in and its message is clear:

PC Magazine is being read regularly and trusted by more of the right people. And with a circulation of 375,000—the largest and fastest growing in the field—that's a lot of right people.

In surveys conducted by Market Probe International, Inc., a well-known independent research organization, customers obtained from lists of three hardware and software vendors identified PC Magazine as the publication they read most regularly.

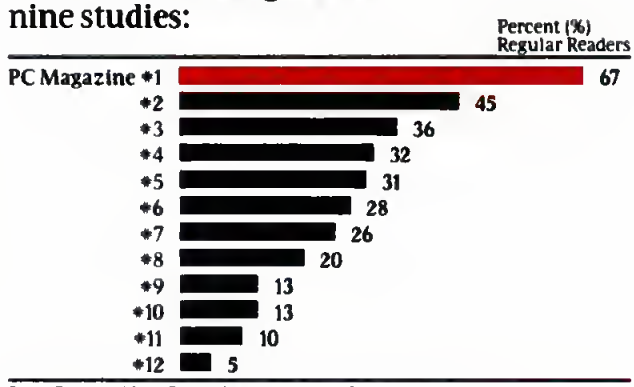
Market Probe was also asked to survey six PC user groups across the country. These groups, founded to provide support and encourage communication among PC users, number many of the country's most influential and knowledgeable purchasers among their members. Once again the results are in and the answer is the same.

In Washington, D.C., Houston, New York City, Silicon Valley, St. Louis and Indiana/Kentucky—user group members ranked PC Magazine as the most regularly read publication.

In all nine studies, when asked to rate the magazines they read regularly, buyers and user group members consistently rated PC Magazine highest for in-depth, objective product reviews based on actual lab tests. They know only too well how difficult it is to make good product choices for their companies and organizations in the fast-moving PC market—and who provides the guidance that makes the difference.

**Regular Readership Scores—Buyer/User Group Studies.**

Here are the averages across the nine studies:




Base: Buyers/User Group Members Who Recommend/ Select Brands of Microcomputer Equipment

If you're an advertiser in the PC market, we'd be pleased to show you our full research reports. We also encourage you to survey your own customers. Their answers will point to the same conclusion: PC Magazine. The largest and fastest growing circulation among brand specifiers in the PC/MS-DOS market.

PC MAGAZINE

**THE BIG BOOK BY ANY MEASURE.**

Source: Market Probe International, Inc. Buyer and User Group Studies, 1986

# *PC* MAGAZINE LEADS YOU OUT OF THE INFORMATION JUNGLE...

Exploring the PC market is a confusing, and often risky, endeavor.

Lose your way, and you lose valuable time. One wrong turn, and you can lose lots of money.

That's why IBM and compatible PC users look to *PC* Magazine. *PC* Magazine eliminates the risk in purchasing decisions with comparative reviews and product evaluations from the PC Labs, where products are tested the way you use them every day. It's the pathfinder to products that meet your specific needs —and those of others in your company.

*PC* Magazine puts you on the trail to new applications with power tips and special reports that will help you make the most of your system.

*PC* Magazine goes one step beyond leading you through the microcomputing jungle. *PC* Magazine leads you *out* of the jungle to the PC environment that meets your daily demands.

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**$1,295**

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## AT&T 6300 + PERSONAL COMPUTER

With 512K RAM, high-capacity 1.2-MB floppy drive, monochrome monitor, UNIX operating system capabilities, MS-DOS operating system and GW Basic Software

**$2,995**

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Okimate 20 Color Printer ..... $99.95
Okidata 182 (NLQ included) ..... $239
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Okidata 292E with Module .... $ CALL
Okidata 293E with Module .... $ CALL

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NEC JC1401P3A MULTI-SYNC MONITOR

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**IN STOCK!!!**

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KEYTRONICS KB5151 KEYBOARD

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D-635 ..... $755
D-80IF ..... $1,499

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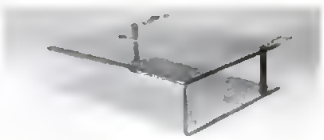

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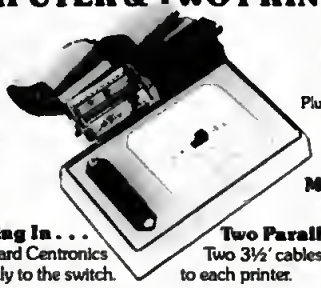

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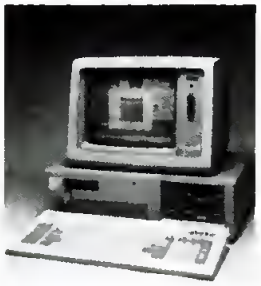

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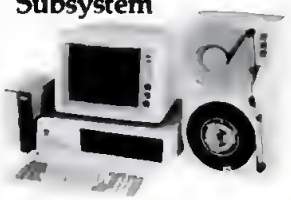

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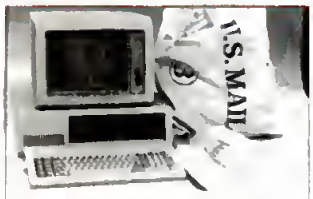


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PC MAGAZINE

# COMING UP

**HIGH-END AND LOW-END DATABASES** For every kind of data, there seems to be a database that will handle it. Alfred Poor and Joe Desposito look at six databases, three simple and three programmable and relational, to find out how different these two categories can be.

**SUPERCALC4 CLOSE UP** Bruce Brown scrutinizes an increasingly popular program that has won wide praise from spreadsheet aficionados everywhere. Is the top-of-the-line spreadsheet competition now a two-horse race?

**PROGRAMMING WITH CLARION** What looks like COBOL, BASIC, or PL/1 but isn't any of them? Barrington Systems' Clarion, a programming language that's getting noticed for its relative ease of use. Loaded with prewritten utilities, it allows you to implement steps without having to write all the codes, and programmers are singing its praises. Richard Aarons investigates.

**FIRST-RATE AT ALTERNATIVES** All the recent talk has been about inexpensive AT-compatible machines, but users who don't mind paying more for a familiar name will find plenty of models to choose from. Winn L. Rosch looks at the latest innovations from Sperry, NEC, Core, and Tandon.

**WHAT'S NEW IN MICE** Phil Wiswell lets seven mice loose on his desk to find out which ones perform the best and how well traditional mice compete against their optical cousins.

**AT MULTIFUNCTION BOARDS** Getting the most out of your AT means more than just acquiring a great hard disk. Why not consider adding a multifunction board designed specifically for an AT? One of the six boards in this review may be just the thing you (and your AT) need for optimal performance. PC


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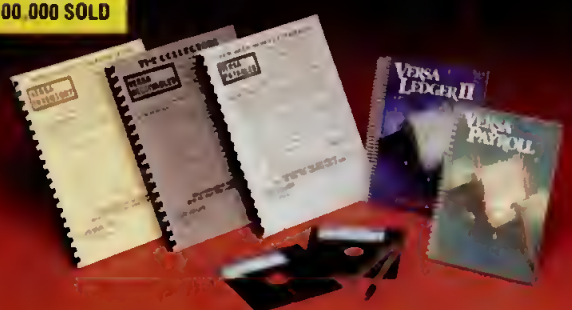


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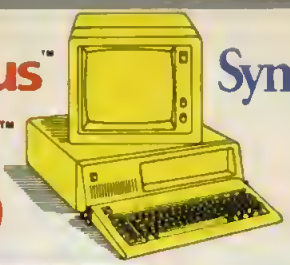

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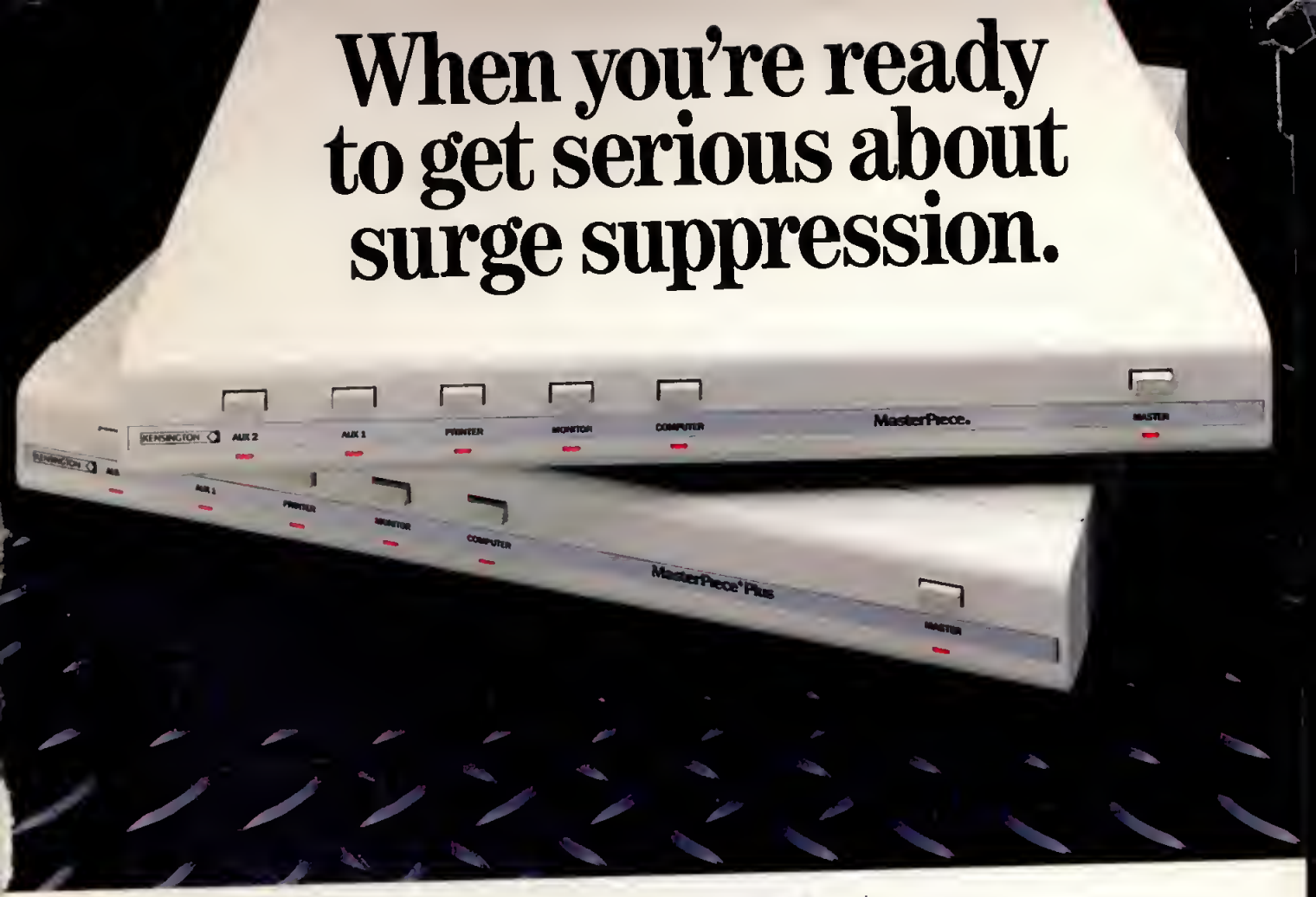
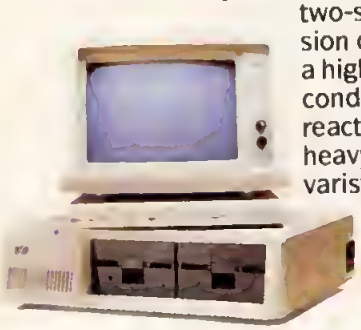



Here's important advice for PC users. With test after test proving that 70-90% of all PC malfunctions can be traced to disturbances in the power supply, a surge suppressor is the first accessory you should buy for your PC.

But don't put your trust in just any surge suppressor. Get one that gives your whole system superior protection. One that's engineered to the highest specifications.

Get a Kensington Master Piece or Master Piece Plus. Computer dealers will tell you they're the most popular PC surge suppressors. And the most serious. Because at Kensington, we're dedicated to giving your PC the best possible protection.

That's why Master Piece contains a unique two-stage surge suppression circuit incorporating a high-speed silicon semiconductor for the quick reaction necessary and a heavy-duty metal oxide varistor for the brute force required to keep even the largest surges from penetrating into your system.



| | Master Piece and Master Piece Plus |
|---|---|
| Meets IEEE 587-1980 Category A | ✓ |
| Meets IEEE 587-1980 Category B | ✓ |
| UL Listed | ✓ |

*The right surge suppressor passes all the tests*

And that's why Master Piece Plus is the communications user's dream-come-true. Its additional circuitry smoothes surges, spikes and noise on the telephone line, protecting your modem and increasing the reliability of your data communications.

The circuitry in both Master Piece and Master Piece Plus is designed to exceed Category A of IEEE* specification 587-1980, as well as those established by UL†.

Sound good? Keep reading, it gets even better. Our circuitry also exceeds Category B of IEEE specification 587-1980. Under this category, created to guard against the severe spikes near the main power distribution panel of a building, Master Piece will even protect your PC from a simulated 6,000 volt lightning strike with a 3,000 amp follow-on current.

Now, this may look to you like we're taking more than the necessary precautions. And actually, we are. But after all, isn't that what you expect from the best?

Master Piece ($149.95) and Master Piece Plus ($179.95). For the dealer nearest you, or to speak to a Kensington sales representative, call (800) 535-4242. In NY (212) 475-5200.

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